HIGH-CAPACITY FUSES

The ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXVII
No. 3017

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SEPTEMBER 20, 1935

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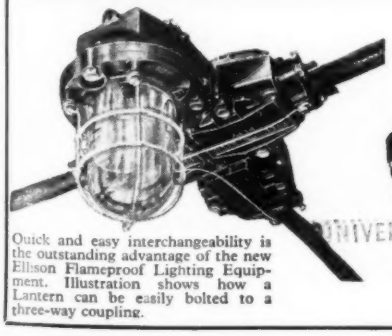

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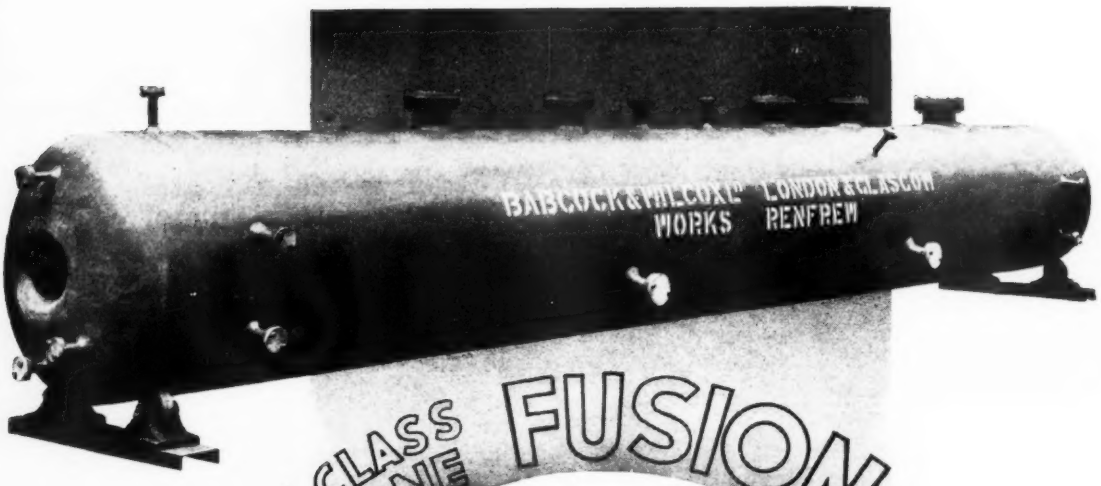

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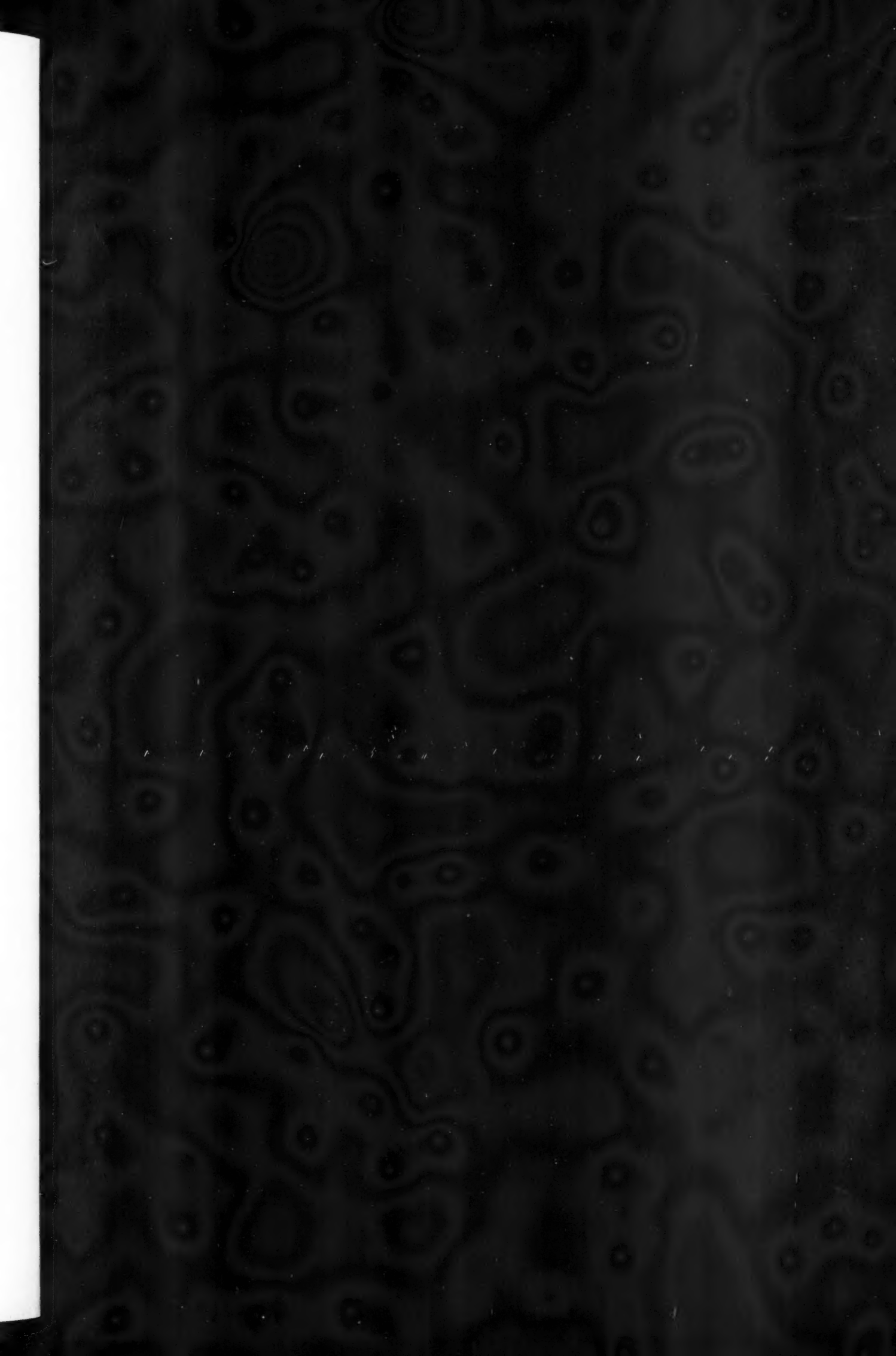


The
Electrical Review

VOL. CXVII. SEPTEMBER 20, 1935. No. 3017.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY. Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Hop 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Index to Advertisers—See page xi.

Principal Contents:

	PAGE
Safety with A.C.	363
A Neutral Relay. By A. G. Bullen	366
High-capacity Non-rewireable Fuses	367
Electro-medical Treatment in Paris	368
Pumps for Farm Use. By F. E. Rowland	369
Water-heater Control. By J. Russell Hickmott	370
Electricity Supply Costs. By D. J. Bolton	371
On-load Tap-changing	373
Electric Cooking Economy. By G. Wilkinson	374
Correspondence: Synthetic Rubber; A Motor Control Problem; Electrode Water-heating; Patchy Street Lighting	375
Discussions at Norwich	376
New Apparatus and Devices	377
British Overseas Electrical Trade	379
New Books	380
Business and Industrial Notes	381
Electricity Supply	384
Traction	385
Communications	386
Contract Information	387
Notes	388
Our Personal Column	389
Financial Section	390
Patent Specifications	393
New Work for Contractors	394

Safety with A.C.

THE merits of the a.c. three-phase four-wire system of distribution have brought about its adoption in leading cities of the world. In Great Britain only about 3½ per cent. of the generating plant capacity is d.c. Out of 655 undertakings in this country in 1932-33, 284 supplied a.c. only and 92 d.c. only, the remainder being mixed a.c. and d.c. The d.c. networks are being converted to a.c. as rapidly as circumstances permit. In collieries also the change-over goes on, and a.c. machines now form nearly 85 per cent. of the total h.p. installed.

Pressures between 200 and 250 V a.c. at consumers' terminals are declared by more than 630 undertakings. In spite of this extension of the use of a.c. systems at 200 V or more between phase and neutral, which has been accompanied by a rapid increase in the kWh sold and—more important still—in the number of people using electricity, the total of electrical accidents—even in the home, where developments lately have been most rapid—has remained very much what it was when the consumption was materially less than it is to-day and the proportion taken as d.c. was much higher.

This being so, we believe that Mr. B. C. Chatterjee, Head of the Department of Electrical Engineering, Benares Hindu University, takes an unduly pessimistic view of the risks attached to the use of 230 V. a.c. for domestic purposes in an article contributed by him to a Bombay publication, *Science and Culture*. His objection is based on the difference between the r.m.s. and maximum values of a.c., and he points out that 230 V a.c. has a real value of 325 V compared with 230 V d.c. He might have added that, at supply frequencies, a.c. causes physiological reactions that add to the $\sqrt{2}$ effect.

Such differences, however, cannot be held to account for the greater number of accidents with a.c. These are mainly due to its predominance, and it could be shown that accidents at high voltages are no more common than those at low voltages, but this would be entirely misleading. One cannot handle either 230 V d.c. or 325 V (maximum) a.c., with impunity, a shock at less than 40 V having caused death.

Mr. Chatterjee's information regarding voltages in use in Europe appears to be incomplete, as he refers to only 88 out of 341 installations in the United Kingdom as being entirely a.c., whereas the latest official returns are as given above. He also gives the names of several Continental cities in which d.c. or 110-V a.c. are declared, whereas in most large towns abroad the standard is 380 220 V and a.c. voltages of 200 or more are in common use. Mr. T. C. Gilbert is quoted in support of the case against a.c., but he merely faced facts with a view to putting forward constructive proposals (which appeared in these columns) for providing protection against the risks envisaged, especially in rural areas.

We certainly do not believe in pretending that all is as well as it could be, or in deprecating criticism by which improvement can be made, but the way to secure the greatest practicable safety is not to retrogress by giving up the advantages of a.c. (which would not by any means eliminate risks), but to use all the methods that science can place at our disposal to guard against causes of danger to the consumer.

Now Port Sunlight

THE closing down of the Port Sunlight 16,000 kW generating station of Messrs. Lever Bros. is the most recent stage in the series of change-overs of large industrial plants to public supply which has included J. & P. Coats at Paisley, Stewarts and Lloyds at Corby, and the Firth-Brown steel works at Sheffield. Port Sunlight was one of the best of the private industrial plants and was noted for its high boiler-house efficiency. It met the electrical requirements not only of Messrs. Lever Bros. for the manufacture of soap and allied products and their electrified garden city but also of the tenant industrial concerns on the estate of 2,000 acres with a total population of

20,000. The station had many interesting features (which were described by us on January 1st, 1932), including the first stoker-fired boiler in Europe to be equipped with a Bailey furnace. Its output of 40 million kWh per annum was comparable with that of many industrial towns, such as Birkenhead in whose area it is situated, but its load factor was better. Advantage has presumably been taken of Section 1 of the 1935 Act under which the Central Electricity Board may make an agreement to close down any station the operation of which is controlled by a local supply undertaking.

Paying for the Privilege

SOME rating assessors in Scotland have adopted the practice of raising the valuation of houses possessing electrical installations. Another case of this kind was revealed at Haddington last week when a tenant unsuccessfully appealed against an extra assessment of £1 on account of his installing electricity. Although we may feel that the value of a house is enhanced by an electrical installation, the proper point for consideration is whether or not electricity is an alternative service to gas. As it certainly is there is no justification for any increase in rates when gas is replaced by electricity. On a previous occasion a similar appeal was successful and so it seems that there is need for a definite ruling upon this point.

Rates in the Highlands

RATES are very much to the fore in the electrical sphere nowadays. Another rating appeal, in Scotland again, was heard last week in which the North British Aluminium Co. sought to have its assessment reduced. It was stated for the company that if it were forced to pay the amount demanded it would mean the end of hydro-electric development in the Highlands and the addition of £3 per ton to the costs of aluminium production. As in the minor case mentioned above, the appeal was unsuccessful in the local Valuation Appeal Court but the company is taking the matter to Edinburgh for further consideration.

Pumps for Farms

PROBABLY one of the greatest boons which electricity can afford the farmer is a constant supply of water without trouble—an essential service which should provide an excellent " thin end " for the wedge of complete electrification. It is not enough, however, to say that an electric pump will provide all the water needed by a farmer. Full regard must be paid to the source of the water and the best pump for the job must be specified. In this issue Mr. F. E. Rowland reviews the various kinds of pumps available, indicates their advantages and possible drawbacks, and deals with methods of installation. The article should prove useful to canvassers for the rural load in their efforts to prove to farmers that electricity is a service which pays for itself in many ways.

Permeability

SOME experiments for determining the stable magnetic conditions of cobalt, iron and nickel wires, now being carried out by Dr. T. F. Wall at Sheffield University, are recorded in *Nature*. By passing an alternating current for a few seconds through a length of cobalt wire in hydrogen, the temperature of the wire was raised to 1,200 deg. C. A magnetisation curve obtained after cooling indicated a permeability value that is believed to be higher than that hitherto obtained at room temperature. On extending the experiment, however, by maintaining the temperature in hydrogen at the same figure for several hours, the magnetisation curve, on cooling, gave a maximum value very much less than normal. In view of the influence of permeability on the design of current transformers, protective relays and telegraph cables, among other things, the final results of these investigations will be awaited with interest.

The South African Railways

WITH the completion of the present programme of railway electrification in South Africa approximately 25 per cent. of the Union's traffic, on the present basis of its distribution, will be handled electrically. In the Natal Central area, where the traction load absorbs four-fifths of the load of the Colenso power station and there is consequently little assistance from other sources towards meeting the charges on the 275 miles of 88 kV transmission lines the cost of energy as d.c. at the sub-stations works out at 0.7d. per kWh for 100 million kWh at 50 per cent. load factor. At Cape Town the proportion supplied for traction is three-fifths of the kWh sold to consumers and the rate of 45 million kWh is over 0.8d. In either case there is a substantial margin over the maximum of 0.5d. per kWh given in the Weir Railway Report as the price at which the Central Electricity Board would be prepared to supply d.c. for the British main lines. In so far as the cost of electricity affects the position, we are very favourably situated.

Growing Diversity

WITH the increase in the number of bulk supplies taken, a high ratio of the aggregate demands of individual consumers to the resultant demand at the main distribution centre becomes of more importance than ever. At the same time the greater variety of uses for electricity is an improving diversity factor, and Mr. D. J. Bolton's estimate in this issue of about 6,000,000 kW to give a net load of 4,156,000 kW in 1932-33 (to which the last volume of " Engineering and Financial Statistics " relates) may be regarded as reasonably conservative. Additional diversity may also be expected (due to differences in the peak incidence in local areas) with the reduction in the number of generating stations. How far the trend is illustrated in the growing divergence between m.d. at the generating stations and kW connected (in 1929-30 the ratio was 3.1 and in 1932-33 it was 3.8) cannot yet be determined, as in the intervening period many workshops were idle, but the next volume of the Commissioners' statistics should throw more light on this aspect.

Semi-Storage Cooking

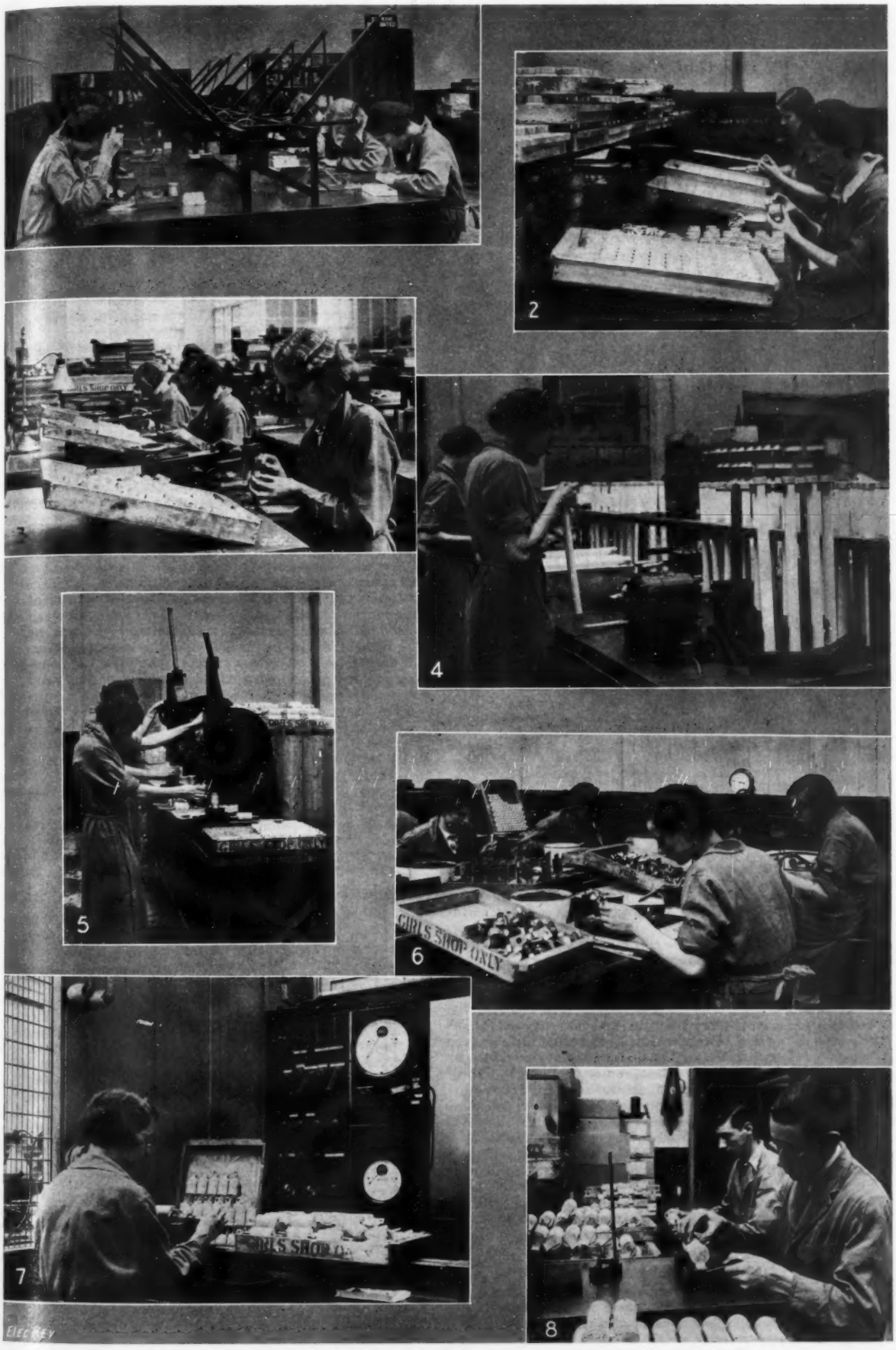
IN this issue Mr. G. Wilkinson, who was formerly borough electrical engineer of Harrogate and therefore knows a good deal about the subject, brings forward once more the idea of the storage or semi-storage cooker. There is much to be said for this arrangement but manufacturers have, with one notable exception, fought shy of it. The reason is, of course, the difficulty of breaking down the prejudice of the ordinary consumer against such unorthodox methods. But it is a subject which it would pay supply engineers to study.

Canadian Power

IN a recent address Mr. Bennett, Prime Minister of Canada, stated that it was his Government's intention, if returned to power at the impending general election, to speed up hydro-electric development in Ontario, Quebec and other provinces. So far as Ontario is concerned there seems to be no need for increased hydro-electric activity at present. Apparently the Province has more power than it needs, for contracts for power from outside concerns have recently been cancelled by the Hydro-Electric Power Commission. But this, of course, was an electioneering address.

Gas Fears

WE had been led to believe that the decline in gas sales during the last year or two was due to the mildness of the winters of those years. But Mr. T. Carmichael, manager of the Portsmouth Gas Co., told a gathering of gas managers last week that electrical competition was responsible. He expressed fears regarding the results of the coming campaign which E.D.A. is undertaking and warned the gas people that they would have to intensify their sales efforts. We trust that Mr. Carmichael's fears will be fully justified.



The Production of English Electric High-capacity Fuses. **(See page 367)**

1. Jig assembly of fuse elements. 2. Cementing inner caps to steatite formers. 3. "Spot welding" fuse element ends to caps. 4. Vibrator outfit for filling h.v. cartridges. 5. Both outer caps clamped simultaneously. 6. "Multiple" soldering between riveted lugs and caps. 7. Precision testing means accurate rating. 8. Alignment of external electrical connections is all-important

A Neutral Relay. By A. G. Bullen

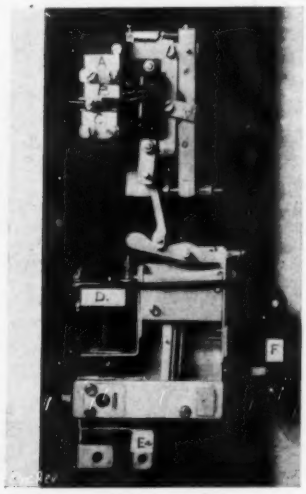
Providing protection where earth resistance is high

ACCORDING to the I.E.E. Regulations metal conduits must be earthed when the supply voltage exceeds 30 a.c. or 115 d.c. It may, therefore, be assumed that if protective apparatus interrupts a faulty circuit before a leakage creates an equivalent potential to earth, all danger from shock is eliminated. The value of the leakage current is of secondary consideration and is limited by the resistance of the earth circuit.

The trip device of an earth-leakage switch requires energy for its actuation, *e.g.*, 2VA. The volts must be kept at the minimum, and where the earth resistance is low it is preferable to use a trip device energised with 200 mA at 10 V than 30 mA at 66 V between conduit and earth. Usually the earth resistance varies considerably in dry and wet seasons; consequently any protective apparatus which depends upon a circuit through earth for its tripping current can be relied upon only while the earth resistance remains fairly low.

Risk with Ordinary Apparatus

Three farms may each be connected to a phase and neutral of a three-phase 400/230-V transformer, the neutral being earthed only at the transformer site. It is possible for the earth resistance between the farms to remain low during a period in which the resistance increases between the transformer and any of the farms, particularly if water tends to drain from the transformer site towards the farms. An earth leakage occurring between the metal frame of apparatus and earth at any one farm could result in a considerable voltage rise between apparatus and earth without actuating an earth-leakage switch at the farm, because of the high earth resistance between it and the transformer. The potential between earth and the live conductors at the two other farms could then increase to 400 V and the low earth resistance between the farms would add to the risk. An earth fault at a second farm would cause two earth-leakage switches to operate simultaneously, since their trip circuits would then be connected in series between two phases.



The short-break switch in the above assembly can be tripped either by the movement of a plunger in solenoid D, or by the magnetic relay above the switch

Since it is impracticable to provide so large a neutral conductor that the normal working load or unbalanced load would cause only a slight voltage drop at the end of a long line, the voltage drop may at times reach 40 V in relation to earth. A trip coil of a relay of conventional type connected between apparatus at earth potential and the neutral would operate by the neutral-earth voltage difference resulting from normal working conditions. Generally, an earth-leakage relay is required to function in such circumstances only when apparatus normally at earth potential reaches a prescribed potential above earth by reason of a leakage from a live conductor.

A relay which is independent of the earth-circuit resistance for its normal operation is being tested by a large supply undertaking. It compensates for neutral-earth potential differences as the neutral load fluctuates and operates with an apparatus-earth voltage rise. The relay is connected between apparatus and the neutral and is referred to as a neutral relay.

How the Relay Operates

The accompanying illustration shows a 50-A short-break a.c. switch controlling the circuit of a phase at E. This switch can be tripped either by the movement of a plunger in solenoid D or by the magnetic relay above the switch acting on a trip lever mechanism. The electrodes (X and Y in the diagram of connections) are placed several feet apart to obtain a resistance through the soil of 10 to 15 ohms, or they may be connected by a bare wire of this resistance buried in the soil.

The current due to the potential difference between earth and the neutral is equally divided between the two parallel paths provided by the relay coils A and C from their electrode connections to their common terminal at B. The coils are differentially connected and have the same number of turns, so that while the current in each coil is equal the relay armature is not attracted.

Mr. A. G. Bullen

Any potential on the apparatus protected caused a current to flow through the relay coil at C to the neutral. Some current may find a path to the electrode Y through the earth resistance, but the loading of the coils is no longer equal and a magnetising flux results due to the differential effect; the relay armature is attracted and acts upon the trip lever of the 50-A switch.

Stray Earth Currents

A stray earth current resulting from a fallen line or leakage from some other installation would load the relay coils when flowing from electrodes X and Y to the neutral. If the coils are equally loaded no magnetising flux results, but a burn-out is prevented by the series solenoid coil D tripping the 50-A switch and opening the relay switch F, which disconnects the coils from the neutral. The particular relay illustrated operates with a 2 A load in the series coil D, or with 0.5 A in either magnetising coil, the applied voltage being 5 V.

A possible disadvantage due to the interruption of supply to a sound protected service by a stray earth current is outweighed by other considerations, *e.g.*, the stray current may originate at a source at a considerable voltage difference from the live conductor feeding the installation, and might cause an insulation breakdown if the supply were not disconnected. The presence of the stray current indicates a failure at some part of the general system and possibly failure of some protective apparatus. Interruption of the supply at the protected installation will usually enable the cause to be traced and remedied before a more serious accident or breakdown occurs.

Even if the neutral should be disconnected, for example, by a fallen line, the neutral relay can still function as an earth-leakage relay of conventional type, depending on a circuit through the earth for its tripping current. As the two earth electrodes are supplementary, a leakage from conduit to electrode Y flows through both magnetic relay coils, which provide a series circuit, thus producing a magnetising flux in proportion to the turns of both coils which are no longer in opposition. The magnetising effect is, therefore, greatly increased, and the resistance of the earth tends to reduce the value of the leakage current so that the relay automatically adapts itself to operating circumstances.

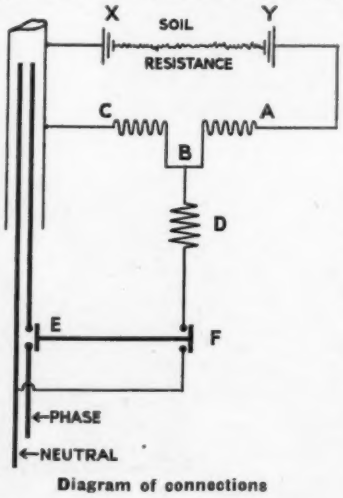


Diagram of connections

When several neutral relays are installed in the same area each provides an alternative leakage current path to the neutral (without itself being tripped) in the event of a local break in the circuit to a neutral. Thus its chances of functioning are much greater than they would be if the relay were operated against the earth resistance to the transformer, a possibility which occurs only if the neutral is disconnected near the transformer. In such a case the action of the neutral relay is the same as that of conventional type of earth-leakage relay, which does not, however, gain advantage from local low-resistance earth-leakage paths.

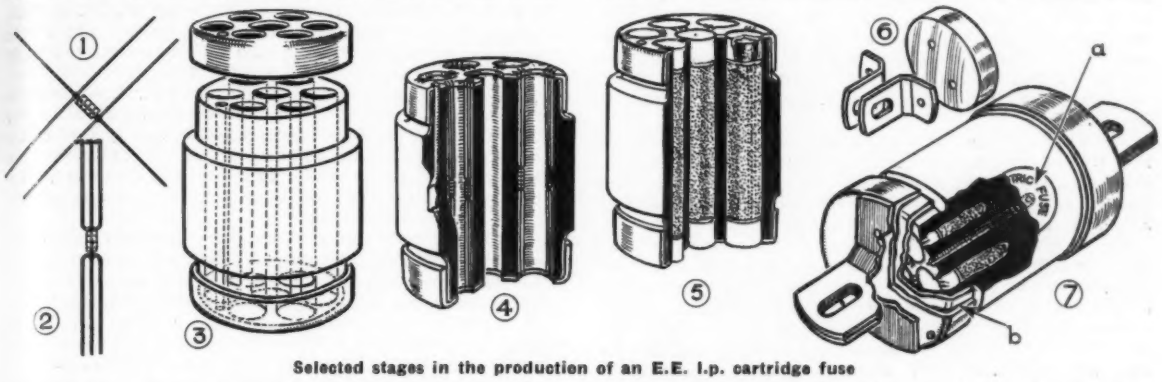
Neutral relays are intended only for use in areas where earth resistance is high due to the lack of pipes and similar metallic conductors, so that although the neutral is technically earthed at each installation, the usual objections to multiple earthing do not apply.

High-capacity Non-rewireable Fuses

Their production and testing

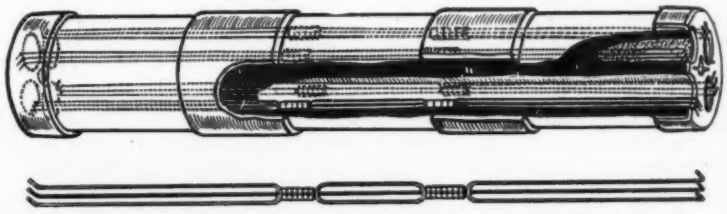
MUCH has been done by the modern cartridge fuse to repopularise the electric fuse generally, as against other means of protection, mainly on account of its high rupturing capacity, non deteriorating quality and accuracy of operation. But modern distribution and installation problems, mainly because of the changed conditions and outlook in respect of rupturing capacity, have also led to its increased use as a cheap means of protection where the only alternative for precision work would be the circuit-breaker.

We recently paid a visit to the cartridge fuse works at Stafford of the English Electric Co., Ltd., by the courtesy of Mr. A. M. Pooley, who is responsible for the self-contained production and selling organisation of the company's fuse-gear section. The English Electric Co. has for some time now produced all the "Zed" fuses made in this country, and it is really the results of improvements effected in this type of fuse which led up to the production of the E.E. cartridge fuses for heavy currents and medium and high voltages. Now the E.E. element construction is incorporated in the English "Zed" fuse.



Selected stages in the production of an E.E. l.p. cartridge fuse

An important idea behind this construction, using a low-resistance high-melting point element, is that the fuse leaves the manufacturer with a precision rating and that when it "blows" it is scrapped, so that no uncertainty of rating is introduced by the user rewiring the fuse himself. The fuse element consists of a short length of wire at the centre which opens out at each end to a multi-wire extension, so that, as was emphasised to us, it is not a case of reducing the element at the middle but of increasing it at the ends. The element is housed lengthwise in a hole through a steatite former and is packed with quartz filling.



Construction of h.p. fuse body with four elements for 100 A

When the fuse "blows" and the wire volatilises, the consequent high temperature and the turbulence caused by the arc sets up a chemical reaction between the metal vapour and the quartz and the result, after cooling, is a non-conducting material which will withstand 5,000 V per inch of length.

The fuse elements are built up on bench assembly jigs in the following manner: Pre-cut lengths of silver wire are laid out so that two lengths cross at right angles a central wire touching at the ends of the "active gap" which is first threaded into a few small insulating beads. The points of contact of the wires are soldered, and the two ends of each cross wire are doubled backward with suitable spacing, so that they merely form the strengthening ends of the element.

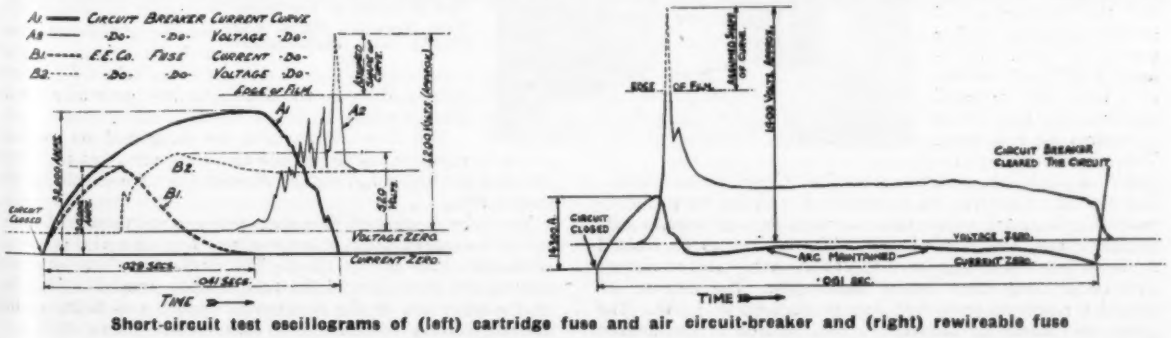
It was instructive to watch a double line of girls, one on either side of a bench surmounted by suitably racked soldering irons for quick manipulation, doing this assembly work. The hard and non-hygroscopic steatite container bodies are received in shapes and sizes and with varying numbers of holes, according to the capacities and types of fuses required, their ends being ground true. Metal caps with suitable holes are next cemented over the ends of the body, so that the holes correspond with those in the container.

Large holes in the body accommodate the fuse elements which also vary in number and size, according to the capacity of the unit, and there is also a small hole near the outside of the body which runs continuously from end to end of the body, except that at about its middle it opens out into an orifice in the exterior wall of the container by which means a fine high-resistance indicating wire threaded through this hole is at first exposed to view.

The fuse elements and the indicating wire are placed in position in the holes and their ends are turned over on to the inner caps to which they are soldered. The element holes are then filled with specially treated quartz filling which is kept securely packed by plugs and seals at the hole ends. In connection with some of the higher-voltage fuses, which are up to, say, 18 in. long, difficulties in packing the powder are overcome in a simple but ingenious way. The incomplete cartridges are freely suspended vertically so that their bottom ends hang near the ends of tapping arms which radiate from a central point like the spokes of a wheel in the horizontal plane.

Through a motor-driven cam "jerks" are imparted to the arms which, in turn, definitely and regularly knock against the bodies. The explanation is that after each side tap to a fuse a definite settling time must be allowed. The sealed containers are now ready to have outer caps fixed to them. These outer caps carry the necessary connection lugs by which the cartridge is fitted to the required equipment.

The copper lugs are first riveted and then soldered to the brass caps, and many a tinsmith could take a lesson from the girls who, equipped with blowlamp, solder and flux, deal with several caps at a time, the caps being arranged in a row so that operating from end to end of each inclined cap the



Short-circuit test oscillograms of (left) cartridge fuse and air circuit-breaker and (right) rewireable fuse

solder runs between the lugs and the caps in an unmistakable and definite way. After being electro-tinned all over, the caps, complete with their lugs, are pushed on to the inner caps as far as possible by hand.

Definite and close fit between the inner and outer caps, by the way, is ensured by the tapered lips of the caps. Pressing home the outer caps is effected in special lining-up presses and final security is afforded by soldering round the rim at the point of contact. Apart from packing—each cartridge has its own specially shaped container—the last operation is filling the indicator orifice with a low explosive mixture and covering it with a paper label. The current carried by the high resistance indicating wire is normally nil, but as soon as the fuse proper blows then sufficient current is passed through it to melt it and the consequent arc ignites the gunpowder, by this means leaving visible exterior evidence of the operation of the fuse.

Before being placed into stock each cartridge is subjected to a voltage drop test, and any cartridge having a drop outside certain pre-determined limits is rejected. It is thus possible to ensure that each cartridge will operate in accordance with its published calibration curve.

We have seen many oscillograms of tests carried out on these cartridges, and those reproduced are particularly interesting as they show how the relatively lengthly arcing time in the case of the cartridge fuse prevented a voltage surge, whereas both the air circuit-breaker and the rewirable fuse produced a voltage surge. All connections were the same for each test, the short-circuit current available being approximately 35,000 A. It will be noted that the rewirable fuse failed to clear, the circuit being finally opened by a circuit-breaker connected in series.

An oscillogram of a test taken by a main line railway company on a 50-A, 750-V traction " Zed " cartridge shows how the short pre-arcing time limited the 600-V track short-circuit current and how the relatively lengthy arcing time prevented a voltage surge. The theoretical short-circuit current was approximately 18,000 A, but the fuse limited the current to 1,460 A, and the induced pressure limit was 732 V.

The company produces medium voltage standard fuses for up to 800 A and 660 V, with rupturing capacities of not less than 25,000 kVA, while for heavy duty 600-A units are available with up to 40,000-kVA rupturing capacities and 400-A units with up to 60,000-kVA rupturing capacities. For transmission work we were shown 11-kV fuses for carrying up to 15 A and 3.3-kV fuses for carrying up to 200 A. But there appears to be practically no limit to the requirements that can be catered for, so that such figures as those above might be by themselves a little misleading. For example, Mr. H. Simmonds, London technical representative, pointed out that a recent call for a 180-A 2,700-V fuse with a rupturing capacity of 150,000 kVA had been met successfully.

It will be obvious that the applications for the fuse units are practically unlimited as the constructional simplicity enables them to be fitted into practically any type of equipment. Indeed, we saw ample evidence at Stafford of how the success of the cartridge fuse is being reflected in the company's business in transmission, distribution and installation switch- and fuse-gear.

Mr. Pooley permitted us to see the orders received on the day of our visit, and in recording the following brief particulars of eight orders taken at random we feel that we are giving the best possible idea of the scope of the subject of this article in a few words:—Two 300-A " Combination " fuse switches for a supply undertaking; a 150-A distribution board for an industrial concern; a three-phase four-wire 300-A service cut-out for a supply undertaking; three distribution boards for an industrial concern; one hundred 11,000-V pole-mounting fuse fittings for a supply undertaking; 4,000 " Zed " fittings and 6,000 "Zed " cartridges for a switchgear manufacturer; 130 heavy-duty large-size fuses for a switchgear manufacturer; and 132 handles and cartridges for feeder pillar units to replace a similar quantity of rewirable fuses for an electricity supply undertaking.

Electro-medical Treatment in Paris

WHAT is said to be one of the most complete installations of physiotherapy in France has recently been completed at the Hôtel Dieu Hospital in Paris. The principal part of the installation is given over to electrical treatment of various kinds, medical massage and mechanotherapy forming only the complement of the electrical side.

A new wing contains a large hall divided by curtains into eighteen small compartments which contain the apparatus for treatment by d.c. or by infra-red or ultra-violet rays. Connected with this hall is a solarium, a room for radiotherapy and one for treatment by short-wave currents, as well as a room for aeroionisation.

The solarium is the first one of its kind in Paris. The light is obtained from four large arc lamps placed against one wall of the long narrow room. Beds line the other wall. In order to obtain a good diffusion of light a metal reflector with corrugations in both directions is fixed above the beds with a curve calculated to spread the light evenly. The patients thus receive direct light from the arcs and indirect light from the reflectors.

The solarium at the Hotel Dieu Hospital, Paris, and (right) the radiotherapy room

The short-wave current installation is used for the production of artificial fevers, either general or local. Wavelengths of 16 to 18 metres are used for general applications, and 12 to 14 metres for local ones. The apparatus is enclosed in a metal case on one side of which are the regulators. The machine comprises an oscillating circuit fed by two symmetrically mounted triode valves serving as oscillators, a self-induction coil, and a condenser. The subject to be treated is placed between the plates of this condenser, plates of various sizes being used for different treatments. The largest, intended for general treatment, can produce up to 1 kW. The plates are placed on each side of the patient at the desired distance. The patient is placed on a stretcher and covered with a kind of hood at one end of which is a tube connected with a powerful fan. At the mouth of the tube is a heating resistance so that the air is heated before passing over or under the patient in order to evaporate the perspiration. The capacity of the air system is about 30 cu. ft. of air per minute at 120 deg. to 165 deg. F. For local applications ventilation is not necessary, and the condenser plates are much smaller. They are fixed at the ends of articulated arms so that they can be brought into any desired position.

Another interesting section of the installation is that for deep radiotherapy. The pulsating voltage generator, which is enclosed in a wire cage to prevent accidental contact, consists of a high-voltage transformer the secondary winding of which charges two condensers through kenotron valves. On the front of the cage are arranged the necessary rheostats to control the heating of the kenotrons and the main control switch. The dosage control desk is connected to the generator by a flexible cable.

The X-ray tubes used are supported on vertical columns and are at one end of an arm. At the other end is a ventilator fan connected with the tube cupola by the hollow arm.

The tube is enclosed in a glass cupola impervious to X-rays, at the bottom of which a series of small screens with openings of various sizes can be fitted. The protection of the operator against the radiations of the tube is thus complete. The fan at the other end of the arm serves for the ventilation of the tube by forcing fresh air to it through the hollow arm.

Pumps for Farm Use. By F. E. Rowland, A.M.I.E.E.

Characteristics of the various types

THERE are few services on a farm which can be improved to a greater extent by the advent of electricity than that of water supply. Frequently, the existing service is primitive. In many cases a hand-pump is used, the laborious operation of which leads to water being used sparingly when its more liberal employment might not only result in improved hygiene and health but also in definite economical advantages such as, for instance, in increasing the milk yield in a dairy herd.

Electric pumps with ¼ or ½ h.p. motors furnish the same convenience of water supply as is obtainable from public mains; consequently, many farmers are disposed to use electricity merely for the sake of obtaining this service, just as it is not uncommon for a householder to install electricity for the convenience of owning an all-mains wireless receiver or an electric iron. The water requirements for average sized farms are of the order of 1,750 to 2,500 gallons per day, of which about 250 to 500 gal. is for domestic requirements and the balance for dairy and stock.

Pumps used on farms generally fall into one of the following categories:—Centrifugal, rotary, piston, plunger, or deep well.

Centrifugal and Rotary

The head obtained with a centrifugal pump depends principally on the speed of rotation, while the height of lift is governed by the speed and diameter of the rotor. The lift can be greatly increased by passing the water through several rotors in series on the same shaft. A typical small centrifugal pump will provide a total lift, including suction and delivery, of from 50 to 90 ft. when running at 3,000 r.p.m., although lifts up to 100 ft. are obtainable with speeds of the order of 5,000 r.p.m. If total lifts of only 25 ft. are required, a pump running at 1,500 r.p.m. may be used.

Among the advantages of centrifugal pumps are simple mechanical design, absence of wearing parts and smooth delivery. A disadvantage is the low suction lift which, as a rule, is not greater than 15 ft. and, in some cases, as low as 10 ft., while air leaks must be prevented on the suction side. Priming is usually necessary, although recently self-priming designs have been introduced which have the additional advantage that the suction lift is considerably increased, in some cases up to as much as 27 ft., but there is a drop in efficiency.

Centrifugal pumps are not so adaptable as piston pumps, because any variation in duty from the standard may entail an alteration in speed and horse power, while in the case of breakdown the services of a sound technician may be required to put things right.

The rotary pump consists essentially of a circular chamber in which water is displaced positively by an eccentrically mounted rotor. Details of construction vary greatly in different designs and, owing to the comparatively low pump speed, some form of external gear is frequently incorporated, although there are several high-speed types suitable for direct coupling. High lift is not usually obtainable, 30 ft. to 100 ft. being normal, and as operation depends on a tight seal between two metal surfaces grit and other foreign matter in the water will quickly wear the pump and in this way will reduce its efficiency.

A variation of the ordinary rotary pump is the paracyclic type, which combines a reciprocating and rotary motion and in which the effects of wear are counteracted. Pumps of this type give a total delivery head of up to 200 ft., including a suction of 25 ft.

Piston Pump Performance

Provided there is sufficient power there is practically no limit to the height to which water can be forced by a piston pump and, when of the double-acting or two-cylinder type, the flow of water is maintained comparatively smoothly. Of recent years small piston pumps of the double-acting, high-speed type, with an air vessel above the cylinder barrel to smooth out fluctuations in the flow, have been installed in greatly increasing numbers in preference to other types. A neat and compact assembly is effected with a ¼-h.p. motor running at 1,400 r.p.m., driving generally by a vee belt.

A positive-action piston pump

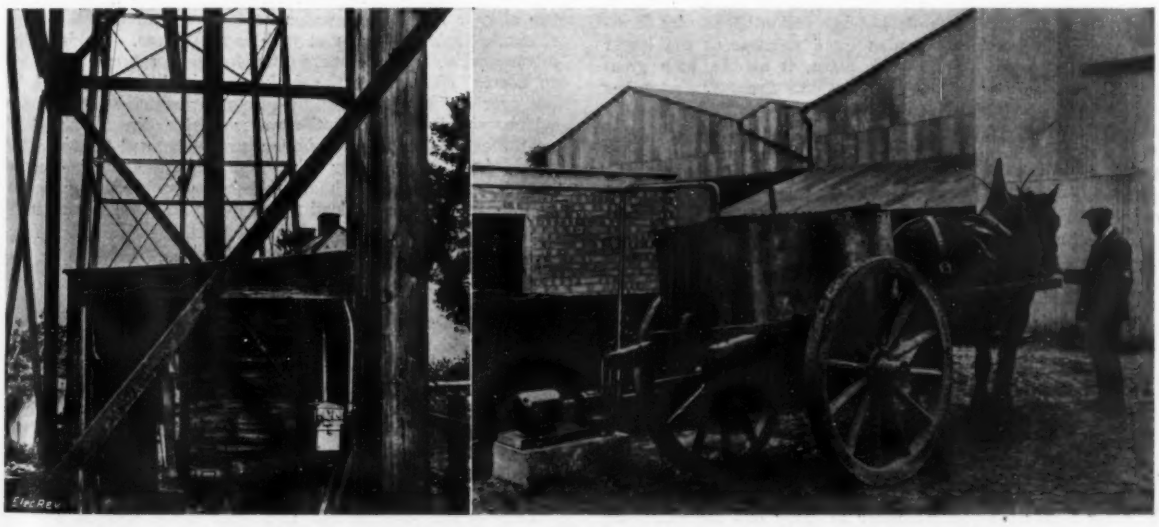
As starting duty may be frequent and onerous, repulsion-start induction motors are preferable for single-phase supplies. The capacity of such pumps is of the order of 250 gal. per hr., with a suction lift of about 25 ft., and a total head of 80 ft., and they may be used for delivering small quantities of water to a considerable height.

Small piston pumps are particularly suitable for farm conditions as they are flexible in operation, simple to adjust and minor repairs can be effected by semi-skilled labour.

Plunger and Deep Well

Plunger or ram pumps are somewhat similar to but are generally larger than piston pumps, the pump chamber being of brass or other non-corrosive metal of 2 to 6 in. internal diameter. They are especially suitable for deep wells, as lifts of 400 ft. to 500 ft. are obtainable. It is customary for the pump chamber with plunger to be lowered down the well, with a power head on the surface for operating the plunger rod; in some modern designs, the rising main forms an extension of the pump chamber to the top of the well.

When the water level in a well is more than 25 ft. down, it is, as a rule, necessary to employ a "deep-well" pump, although, if the depth is not much greater, some such expedient as fitting an ordinary pump in a blind well near the well head or on a platform a short distance down the well can be resorted to. Deep-well pumps are generally of the plunger type, although lately the injection system has been introduced. The principal feature of this system is that



Windmill pump conversion with a 4-h.p. motor and (right) a liquid manure pump employing a ½-h.p. motor

no working parts have to be placed below ground. An ordinary shallow-well pump is placed at the well head, with a T-connection on the outlet; one side of the T-connection goes to the delivery pipe and the other to the power water pipe down the well. At the bottom of the well is an injection device with a non-return foot valve, the whole of which is immersed. By means of a restricted passage with a smooth nozzle with a narrow orifice, the flow of water from the pump raises water through the foot valve and up the suction pipe to the pump. Although the running costs of an injection pump are greater than with the plunger type, the first cost is lower and it is not essential to mount the pump immediately over the well.

Service

Gravity tanks mounted at a sufficient height to give adequate pressure at the various outlets are in general use for water service in this country, and small electric pumps may be employed for filling them, control being either manual or automatic with a float switch.

The pressure-tank system is less well-known in this country, but it has been adopted to a large extent in certain parts of the Continent and in America. Its advantages compared with gravity tanks are that installation costs are lower and a comparatively high pressure is maintained at taps, which saves time when drawing off water. A disadvantage is that there is little reserve in the tank should the pump cease to work.

The equipment consists of a small tank of about 60 to 150 gal., with the pump mounted adjacent to or on the tank, and a pressure-control device, the delivery pipe of the pump being connected to the tank and a service pipe taken from the tank to supply points. When the pump is running, it delivers water into the tank, which compresses the air inside it. When the air pressure reaches a predetermined figure, the pressure control comes into operation and switches off the pump. By this means a constant pressure of water is maintained automatically in the tank, the pump being started when the amount of water drawn off is sufficient for the pressure control to operate. As there is very little storage it is necessary to install a pump with a capacity equivalent to the maximum rate of draw-off. In a typical installation a 250-gal. per hr. pump might be sufficient with a gravity tank of ample size, but if the pressure tank system were employed a pump of 400 gal. per hr. might be necessary. The reserve with a 60 gal. tank would not be greater than about 20 gallons.

Some operating costs of typical small pumping sets (which are not intended to be comparative) under working conditions are summarised below:—

Type of Pump.	Average load watts.	Lift in ft.		Gal. per hr.	kWh. per 1,000 gal.	kWh. per 1,000 ft./gals.
		Suction.	Delivery.			
High-speed piston	192	8	20	291	0.66	0.0235
Centrifugal in blind well	666	20	25	375	1.77	0.0394
High-speed piston with semi-deep well extension rods	217	20	64	115	1.89	0.0225
Centrifugal ...	457	10	25	380	1.2	0.0343
Rotary gear pump	250	10	20	175	1.43	0.0477

[From "Pumps for Farm Water Supply"—C. A. Cameron Brown, B.Sc., A.M.I.E.E., Institute for Research in Agricultural Engineering, University of Oxford.]

Water-Heater Control. By J. Russell Hickmott

For and against various methods now employed

THE many different types of water-heater control adopted by electricity supply authorities leave little doubt that the problem has still to be thoroughly investigated. It is, perhaps, true to say that no attempt at standardisation has yet been seriously considered, probably the chief reason for this being the varying charges made for electricity. The proper development of the water-heating load calls for the co-operation of the whole industry, and until such co-operation is attempted progress will be comparatively slow.

For many reasons the control of immersion heaters by three-heat switches has been adopted by a number of the larger supply authorities. In the first place, it avoids, to a great extent, complaints of high consumption. Secondly, very few water-heating installations are suitable for conversion to fully automatic working, and thus the hand control forms a more standard type of installation. In any case, it is quite easy for a consumer to obtain a constant supply of hot water without a thermostat. The average consumer finds that he can obtain sufficient hot water for the majority of domestic purposes by merely switching on the heater for a short period each morning. It is necessary to use at least a 3-kW heater if satisfaction is to be given. A bath can then be obtained in just over an hour, depending on the quantity of water required.

Another reason why hand control is becoming more popular is the fact that many consumers do not wish to have their hot-water tank lagged. Also, in the modern house the average tank is a tight fit in the linen cupboard so that it is impossible to get three inches of cork round it.

A point often raised in favour of fitting a thermostat is the suggestion of additional safety. Actually there is no danger whatever in not fitting a thermostat, and, to my mind, it is far better for the consumer to carry out the switching than for him to rely on the thermostat, which may fail to operate and cause dissatisfaction by running up a large bill for electricity.

Automatic Control of Immersion Heaters

Generally, the automatic control of any water-heating apparatus, other than self-contained storage heaters, cannot be considered economical unless the cost of electricity is below a halfpenny per kWh. It is only in the smaller type of house where pipe runs are reasonably short that immersion heaters are suitable, but unfortunately the owners of these houses are not in a position to pay more than, at the outside, two shillings per week for a supply of hot water—that is, if they wish to use the heater all the year round, and therefore have to provide some other means of heating the kitchen. If the heater is only to be used in the summer a slightly higher cost will not matter. On the other hand, has the electrical industry to admit that water heating is too costly for constant use and is really only a makeshift? The fully automatic installation is really only of value where cost is not important or where a very efficient installation can be carried out. For the average installation supply authorities would do well if they adopted hand control and reasonably high loading.

Many methods have been adopted to take advantage of the storage capacity of water heaters, and among these the change-over switch has met with some success. Its chief disadvantage is that consumers often forget to return the switch to normal after using the cooker. This difficulty might be got over by incorporating an automatic switch on the meter which would disconnect the water heater directly the load on the other circuits rose above a predetermined figure. This would have the further advantage that the scheme could be introduced into any house whether a cooker was installed or not, the cutting-out load figure being adjusted to suit individual circumstances.

Off-peak Working

Schemes whereby the water-heating load is only in circuit during the night off-peak period have not met with any great success owing to the fact that the storage of hot water has to be sufficient to meet the following day's requirements. To overcome this difficulty the heater is sometimes given an additional period in circuit during the middle of the day. Another problem arises in the mixing of the water, since the hot water loses much of its heat to cold water at the bottom of the tank. Unless a storage capacity of at least 25 gals. is available the idea of night-load working cannot be entertained.

Time-switch control has met with some success abroad. With this type of control an additional meter is not necessary, since the energy consumed can be easily calculated. Time-switches are available that will switch on and off three times every twenty-four hours, and the loading of the heaters can be adjusted to suit the quantity of hot water and the number of hours available to heat it.

Although the time-switch costs slightly more than the ordinary type of meter, this would be offset by the gain of having an almost perfect off-peak load. If at any time the peak hours of the district varied it would be comparatively a simple matter to adjust the time-switches to suit. The time-switches could also be set to suit the requirements of each district, and those sub-stations which were loaded at certain times by some special consumer could be relieved of the water-heating load during the critical hours.

Electricity Supply Costs. By D. J. Bolton

An analysis of fixed and running components

THE object of the present article is two-fold, namely, to analyse the cost of public electricity supply in this country into its constituent elements, and then to build it up again into a two-part form. For the purpose of the analysis the Electricity Commissioners' latest statistical Return gives all the data that is required: for the purpose of the synthesis it will be necessary to use other information, and to make a number of somewhat arbitrary assumptions.

In carrying out this work, certain simplifications have been made, *e.g.*, some items have been omitted from both sides of the balance sheet such as expenditure on and receipts for work done and intersales in bulk. The total receipts or turn-over of the industry can then be identified with the sales to actual consumers, namely, 10,200 million kWh at a mean price of 1.33d., giving £56.6 millions. This total was expended in two chief directions as shown on the two sides of fig. 1, namely working expenses 45 per cent. and capital charges 55 per cent. (In the figure the continuous circle labelled 1932 is divided up radially into sectors whose areas represent the expenditures on the heads indicated.) The working expenses are further divided up under five or six heads as shown in the figure. The capital charges are divided into two groups which may be entitled to disbursements and replacements. The former include all items which are distributed as interest, dividends, profits or contributions to rates. The latter include all items in the nature of saving or replenishment, *i.e.*, reserves and renewals, sinking funds for debt redemption and capital items purchased from revenue. It will be noted that, on the average, approximately equal amounts were expended in these two directions; but the average in this case is a rather deceptive one.

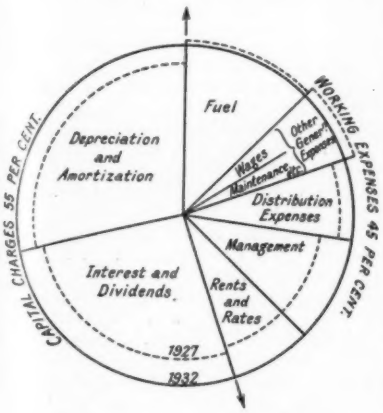


Fig. 1.—Allocation of receipts

There are two main types of organisation concerned in electricity supply, namely, public authority (nearly two-thirds of the whole) and private company (rather more than one-third). There is naturally some difference of viewpoint between the two, and a difference both in policy and in statutory obligations on this matter of renewal funds. There is also the higher rate of interest, even on debenture stock, which usually has to be offered by the private undertaking. As a result it will be found that out of the total surplus of receipts over working expenses distributed by the public bodies 60 per cent. went in reserve and replacement funds, whereas with the companies only 38 per cent. went in this direction. Public authorities are therefore further on in the matter of debt redemption.

Fig. 1 has also been designed to show the changes which have occurred in the five years preceding 1932. Using the same angular sectors the dotted arcs have been drawn so as to enclose areas representing the corresponding figures for five years earlier. It will be seen that the generation working expenses have gone down in these five years in spite of nearly 50 per cent. increase in kWh generated. All the other items have gone up, especially in the cases of management, rates, and interest charges where the increase has been about 50 per cent. in each case.

In the matter of fuel costs the increasing efficiency in these five years has nearly (but not quite) kept pace with the increasing load so that the weight of fuel used has gone up slightly. This, however, has been more than balanced by a reduction in price following the very high figure reached in 1926. As a final consequence the fuel cost in electricity supply is a dwindling factor, both absolutely, and, still more, relatively.

Having examined the various expenditures we have then to divide them into their fixed and running components, *i.e.*, those which are dependent on kW of demand and those dependent on kWh of consumption. In this way a species of "costs" tariff can be built up, representing the expenses incurred up to any given point. A rough division, sufficiently accurate for many purposes, is to take the whole of the fuel as a running cost and all other expenses as fixed. Somewhat greater detail is attempted below, where the costs are put into four main groups, namely, fixed and running costs of generation, and fixed and running costs of transmission and distribution. The results are then illustrated by means of a diagram.

Starting with the fixed costs, the first and most obvious items in this category are the capital charges. By taking the gross surplus of receipts over working expenses and dividing this by the total capital expenditure a figure of 8.0 per cent. is obtained. This surplus was distributed as interest, dividends and provision for depreciation and amortisation, *i.e.*, in what may be broadly termed capital charges and disbursements, although the rates were different in different blocks of capital and types of undertaking. If, then, a *uniform* percentage of this magnitude be assigned to each group of capital expenditure it will be possible to form a rough estimate of the cost of owning this particular group of assets. Moreover, the total of the "charges" thus obtained, when added to all the annual running expenses, will equal the total revenue (or kWh sold multiplied by mean price per kWh).

It will be appreciated that this method of apportioning capital charges is an allocation of receipts rather than a statement of costs. Nevertheless, it forms a convenient approximate assumption by means of which the costs can be detailed. On this basis the capital charges for generation are as shown in the first two lines of Table I.

The working expenses of generation are usually given under four heads:—Fuel; salaries and wages; repairs and maintenance; oil, water and stores. (In the later returns these last two are merged but this is not very material since the fourth is only a small item.) A scheme has been devised by the Electricity Commissioners and employed in costing supplies from selected stations whereby these four groups of costs can be allocated between fixed and running components.* The pro-

* Leaflet 1015. Electricity (Allocation of Cost of Production) Regulations, 1929. (H.M. Stationery Office, 1d.)

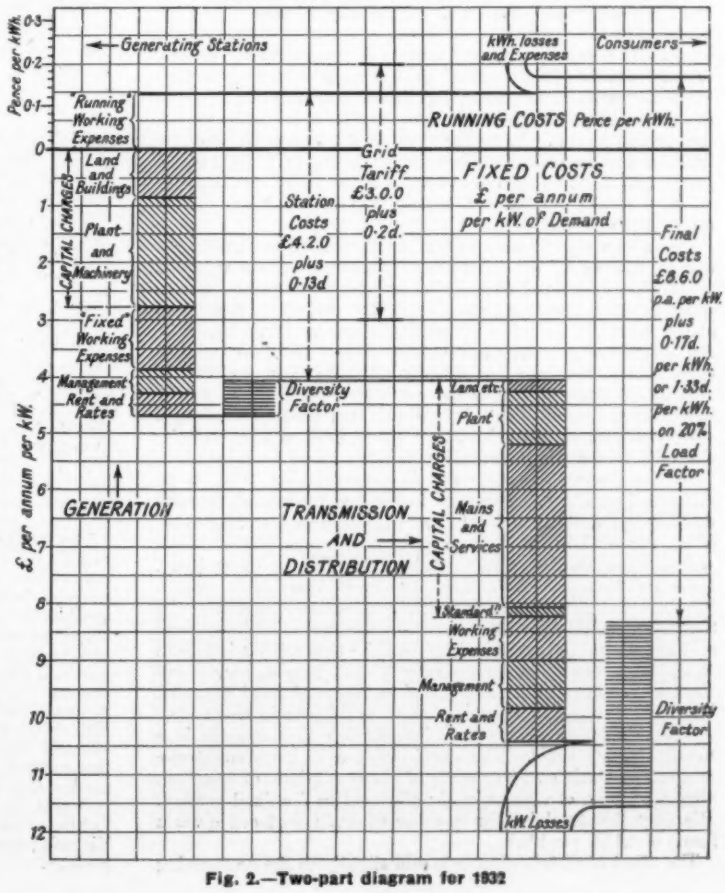


Fig. 2.—Two-part diagram for 1932

portions vary with the station load factor, since the amount of fuel, &c., wasted in keeping steam up ready to meet the peak will depend on the magnitude of the peak in proportion to the mean daily load. Taking the average station load factor for the year in question (34 per cent.) the total of the fixed portions of the generation working expenses is shown in the third line of the table.

TABLE I.

	10^6 £
Land, buildings, etc., for generation, at 8% p.a.	3.52
Plant and machinery for generation, at 8% p.a.	8.04
"Fixed" portion of generation working expenses (Fuel, 1.32; wages, 1.83; repairs, etc., 1.46.)	4.61
Management (30% for generation)	1.72
Rents and rates for generation	1.64
Total fixed costs for generation	19.53

Dividing by 4.156×10^6 (kW) $\times$ 1.15 (diversity) gives £4 2s. p.a. per kW. at station.

Land, buildings, etc., for distribution, at 8% p.a.	0.95
Plant and machinery for distribution, at 8% p.a.	4.44
Mains and services for distribution, at 8% p.a.	13.77
Standardisation	0.72
"Fixed" portion of distribution working expenses	3.68
Management (70% for distribution)	4.01
Rents and rates for distribution	2.81
Grand total	49.91

Dividing by 4.156×10^6 (kW) $\times$ 1.6 (diversity) $\times$ 0.9 (losses) gives £8 6s. p.a. per kW. sold to consumer.

Running costs of generation 6.40×10^6 multiplied by 240 (pence) divided by $11{,}800 \times 10^6$ (kWh sent out) gives 0.13d. per kWh at station.

Adding the running cost of distribution (0.74×10^6) and dividing instead by $10{,}200 \times 10^6$ (kWh sold) gives 0.17d. per kWh sold.

Management expenses have been taken as entirely fixed in character and have been arbitrarily allocated as 30 per cent. for generation and 70 per cent. for distribution. Rents and local taxation (*i.e.*, rates) are also included at this point, but income tax has been treated as a capital disbursement, thus following the practice first introduced in the 1932 Return. In order to allocate these rents between generation and distribution they have been split up in the ratio of the capital expenditures on these two heads.

The total fixed charges for generation are then shown, and the next step is to express these as a rate or tariff. The aggregate maximum demand on the station was 4.156 million kW, but the sum of the demands on the feeders leaving the stations would be greater than this in the ratio of the diversity at this point. Assuming a figure of 1.15 for this, the fixed charge at the station becomes £4 2s. per annum per kW of demand met by the station.

The fixed charges for transmission and distribution follow exactly similar lines, and will be sufficiently clear from the table. The same percentage rate has been taken on the capital expenditure, thus giving the annual charges shown. Capital expenditure on the overhead grid lines and certain unallocated items which are being liquidated over a period of years are omitted because they are likely to give a false idea of the economic position. Thus the grid would appear as a transmission cost, although it is actually being paid for on the generation side. This omission does not upset the balance sheet, it merely results in a slightly higher percentage on the other capital items.

The working expenses of distribution will be to some slight extent affected by the kWh supplied and cannot be regarded as exclusively a fixed charge. They have therefore been allocated between fixed and running in the ratio 5:1, this being about the ratio used for generation wages and repairs. The items for management and rents are merely the total expenditures minus the amounts already allocated for generation. Adding all these fixed charges gives the total shown at the foot of the column. But before this can be expressed as a rate, two factors must be taken into consideration, namely, diversity factor and distribution losses.

In the present calculation it is assumed that there is an additional diversity, subsequent to the h.p. feeders, of approximately 1.4, making a total diversity from power station to consumer of 1.6. The capacity to meet consumers' demand will therefore be increased in this ratio. On the other hand, there will be a fall in kW capacity due to losses in the distribution system, and this has been taken as 10 per cent. (The figure is not given in the Return but the loss in kWh is given as 13¼ per cent. and the kW loss will be appreciably less than this.) The aggregate of consumers' maximum demands will then be 6 million kW, and dividing the total fixed expenses by this gives the fixed charge of £8 6s. shown in the table.

The calculation of the running portion of the costs is a much simpler affair. The chief expense is incurred at the generating station and consists of those portions of the fuel, wages, repairs, etc., not already allocated to the fixed portion. Dividing this total by the number of kWh sent out gives a figure of 0.13d. per kWh.

The effect of distribution is to add slightly to the costs owing to the running portion of the working expenses. In addition, there is a loss of 13¼ per cent. in kWh, giving a smaller denominator, namely, 10,200 million kWh sold to consumers. This quotient then gives a figure of 0.17d. per kWh. It is worth noting that a simple quotient of total fuel cost divided by kWh sold gives a very close approximation to this figure.

A Two-part Diagram

The two-part diagram shown in fig. 2 has been designed to illustrate the two-part allocation carried out above. A horizontal zero line runs across the diagram; running costs are plotted as ordinates above this line and fixed costs below it. The left-hand side of the diagram represents the generating stations, and the right-hand side the final consumers. The two sets of costs thus form a belt or river gradually building up as it flows from left to right and is swelled by various tributaries.

The scale of the lower portion is in £ per annum per kW of demand, and on this basis are plotted the various costs shown in the table. Generation fixed costs are shown occurring at the extreme left and distribution costs farther on. The effect of the distribution losses in decreasing the kW available to meet demand is shown as a tributary increasing the price per kW. Diversity produces the opposite effect, and is here shown by horizontal shading leading to a reduced ordinate.

The top portion of the diagram is scaled in pence per kWh, and it illustrates graphically the concluding figures of the table. It will be seen that the various components combine to produce two sets of two-part costs, one for the station busbars and the other for the consumer. By way of comparison a typical grid tariff is shown on the figure, namely, £3 per annum per kW plus 0.2d. per kWh. (This allows for some of the progressive reductions in the kW charge.) It will be noted that the mean generation costs give a higher fixed charge but a lower running charge than the grid tariff.

The stream of costs shown in this figure can evidently be regarded as a whole, not merely as two independent portions. That is to say, for any given load factor the two can be added or resolved into a single overall price per kWh. Now the mean station load factor was 34 per cent., but the mean consumers' load factor will be lower than this in the ratio of the overall diversity factor (1.6). It is also necessary to allow for the difference between the loss in kW and the loss in kWh, giving a final load factor for the average consumer of nearly 20 per cent. As a check on this it will be found that at this load factor our two-part charge of £8 6s. plus 0.17d. becomes equivalent to 1.33d., the actual mean overall figure. Furthermore, in this particular diagram the two scales have been so chosen that at 20 per cent. load factor all vertical distances represent pence per kWh on the scale shown in the upper part. The total widths of belt therefore give a visual impression of the importance of the various items to the average consumer.

In conclusion, the warning should be made that the pairs of figures arrived at above and illustrated in the diagram are in no sense "tariffs." They simply represent precise statements of average costs at the points concerned. Even when the form is suitable for an actual tariff (*e.g.*, for industrial power supplies) the magnitudes would probably not be. It is true that the figures represent costs and are so calculated that if the "average" consumer were so charged it would bring in the required total revenue. But from the practical point of view such a tariff would be unpopular on account of its high fixed charge, and it would be better to reduce this and increase the running charge so as to bring in the same total revenue. This would actually be fairer as well as more politic, since it would make allowance for what I have called "differential diversity," *i.e.*, the greater probability of diversity obtainable from the low load factor consumer.

Colours for Signal Glasses

The British Standards Institution has just issued two specifications for railway purposes, one dealing with colours for signal glasses (B.S.S. No. 623-1935) and the other for plano-convex (bullseye) lenses (B.S.S. No. 624-1935). The former specification does not refer to the colour or brightness of the signal as seen by an observer, but to the colorimetric and photometric properties of the lenses or other glasses under specified conditions suitable for laboratory tests. In the clauses dealing with tests a detailed statement is given of how the measurements shall be carried out. The specification for plano-convex (bullseye) lenses gives the diameter, focal distance of the lens, thickness of the edge of the rim, the colour, the method of measurement of the transmission, and five methods of finish for the lenses.

Copies of these specifications may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d., including postage.

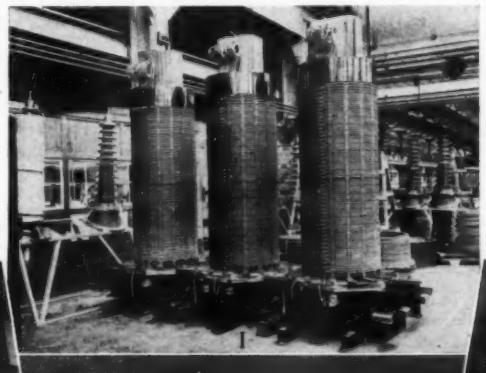
On-load Tap-changing

Recent developments in transformer design

SEVERAL interesting new developments were seen in the course of a recent tour through the Walthamstow works of the Fuller Electrical & Manufacturing Co., Ltd. The company has just completed a large extension to the factory to which the motor production has been transferred, thus leaving the entire original floor area free for the production of transformers and on-load tap-changing equipment.

An automatic voltage regulator has been developed specially to meet the demand for a small reliable unit of the automatic type to take care of any excessive voltage drop in l.p. lines. It is voltage controlled, has very few moving parts, and is operated by an induction disc motor. The double wound transformer is arranged with one winding in series in the line and the other winding energised across the line, and it either boosts or "bucks" the voltage, according to the position of the switches placed on the primary side of the transformer.

These switches carry only a very small percentage of the normal full-load line current. They are of the "out of centre" spring-loaded type and are locked both when in the closed and open positions. The regulator gives a definite boost independent of the power factor of the line, and there is no phase displacement. The losses are reasonably low and the complete unit comprising relays, transformer and switches is fitted in a dual-compartment sheet-steel tank. The transformer is oil-immersed in one compartment while the switches and relays are suitably supported in the other compartment which is provided with a hinged door to facilitate inspection.



1. A 15,000-kVA, 132/33-kV transformer under construction. 2. Welding a large transformer tank. 3. A tube-gilling machine in operation. 4. A gilled-tube transformer tank

Driving mechanisms for h.p. regulators

High-pressure Regulators

We saw a number of the company's high-pressure regulators in various stages of manufacture, ranging from 66-kV fully insulated equipments suitable for large transformers down to small units suitable for 6.6-kV, 500-kVA transformers. We were informed that as many as seventy high-pressure regulators were in hand at the time of our visit. Both the standard large and small types of driving mechanism for the electrical operation of on-load tap-changing gear have been unchanged in design since their inception, and these mechanisms are built for stock in batches of twenty-four at a time.

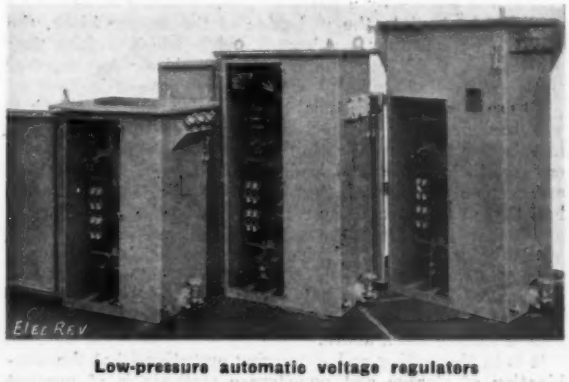
The resistor type of h.p. regulator can be provided in either a front-cover removable type tank or in a form in which the switchgear tank can be lowered to the ground full of oil at any time, for inspection of the contacts, without it being necessary to disturb any external connections or remove any oil. While the advantage of the resistor equipment lies in reduced wear on the contacts, continuously-rated mid-point reactor equipments are supplied for cases where there are many operating positions, low densities being adopted to reduce contact wear and any voltage fluctuation during a tap change.

Several transformers for use with on-load tap-changing equipment were seen in the course of assembly, and the care exercised to reduce magnetic out-of-balance to an absolute commercial minimum was stressed.

Mr. J. H. Gill said that in the days before on-load tap-changing gear became popular, the average transformer was provided with tappings at plus and minus 2½ and 5 per cent. by an off load tap switch.

This range as a rule could be safely dealt with in one section, usually in the middle of the windings, but with the growth of on-load equipment the range has increased considerably, and it is no longer a desirable or good practice to arrange the tapping section in one place in the windings. The company arranges transformers of this nature with either a special regulating winding which is wound on a bakelite cylinder, and the copper conductors for each tapping section run the full length of the winding, or with the tapped winding in a number of sections distributed over the winding length so that more perfect electro-magnetic balance is obtained.

In the winding shop we saw special machines to paper-cover very small diameter copper wire. This is claimed to be superior to enamel and cotton covering. Small coils are wound on steel formers in such a way as to ensure great accuracy and to make a rigid construction, and where possible continuous disc windings are used to avoid soldered joints.



Low-pressure automatic voltage regulators

Amongst the transformers in the course of assembly were noticed two 30,000-kVA, 132/11-kV units for the Central Electricity Board, and five 15,000-kVA 33/11-kV transformers for the North Metropolitan Electric Power Supply Co. All these transformers have resistor type on-load tap-changing gear.

The company utilises to a considerable extent the gilled tube design of tank by which the number of tubes is very considerably reduced. The tubes are gilled on a special machine of the company's own manufacture, by which the strip is shrunk on to the tube hot. The strip is electrically heated while it is being wound round the tube, the heating current being passed along the strip itself and through the tube on which it is wound.

Exhaustive tests made with this class of tube have shown that it is perfectly suitable for installation over a long period of time at any exposed atmosphere.

The new tank shop has up-to-date machine tools for tank manufacture, including ten " Asea " portable d.c. welding sets. These welding sets have several interesting features including a fully adjustable range to suit various electrodes.

A feature of the transformer test bed is the arrangement for carrying out duration runs on ratio regulators. Before any on-load tap-changing gear is despatched a duration run lasting for at least 500 operations is carried out.

It is also of interest to note the method adopted in shipping transformers overseas. The company has patented a special method of transport with the transformers despatched in their tanks filled with dry compressed air, the oil being sent separately.

A large number of transformers have been delivered in this manner with very successful results, with a saving in erection, as no drying-out on site is required.

Electric Cooking Economy. By G. Wilkinson, M.I.E.E.

The combination of non-storage and heat-storage methods

AN electric cooker for a small family will, when in full use, absorb aproximately 5 kWh, and the consumption under normal conditions of operation will amount to about 6 kWh a day, which corresponds to a load factor of only five per cent. How can supply authorities expect to sell energy for cooking at a low price under these conditions? A flat rate of ¼d. per kWh plus a considerable fixed capital charge is assumed to be a reasonable tariff, and it probably is so under the present adverse conditions.

The practical remedy both for excessive costs of distribution and the low load factor of individual cooking outfits lies in the introduction of thermal storage methods. Such methods are not new, but hitherto the serious mistake has been made of introducing thermal storage at the sacrifice of cooking efficiency. So far as the writer's knowledge goes no heat-storage cooker has yet been built which is capable of meeting all the requirements of a domestic kitchen. The thermal storage cooking has to be supplemented by separate and normal grilling equipment, which adds considerably to the cost of the outfit.

True reform and economy in electric cooking lie in the judicious combination of non-storage and heat storage methods in what may be appropriately called semi-heat storage cookers, the ovens of which follow present practice, save that it should not be possible to switch in more than half the full oven load during the short periods the grill is in service.

It is the boiling and grilling (or toasting) processes which are inefficient and wasteful; they are also largely responsible for the extremely low load factor of individual cookers. One characteristic of these processes is the initial demand for a great " burst " of heat for a short period of time only, grilling being a comparatively short process. In the case of boiling the " burst " is also required for a short period, namely until boiling temperature is reached, after which a comparatively small amount of energy will maintain temperature.

Heat generated by a small constant flow of electricity, say 100 W, and stored in a block of cast-iron effectively heat insulated, is eminently suited to the supply of the short spasmodic bursts of heat referred to, while the smaller and longer sustained heat service to complete the cooking operation can be more economically and conveniently supplied direct from the mains.

The Storage Block

On these lines a comparatively small amount of stored heat is called for and the metal block required for its storage is of small size and weight, so that it can be placed in the centre of the boiling platform between two low rated hot-plates. The block is heat insulated at the top by a light hinged cover and at the bottom by a movable slab. Heating elements for grilling are fixed to the underside of the storage block, the heat from which they supplement and in which position they are also protected from the currents of cold air that so effectively cool the elements of the griller at present in use.

To use the grill, the insulating slab below the heat block is withdrawn and the toasting tray is inserted in its place and in this way the normal rating of the grill is reduced by half, or, say, to half the total loading of the oven, the switching arrangements being such that the grill loading cannot overlap half that of the oven. The residual heat in the grill elements and frame soaks into the superimposed heat block and is available for use later. Incidentally, the total loading of the oven of any given size can be lower than that of an oven of a non-storage cooker, as it is never quite cold, by reason of the small amount of heat soakage from the continuously heated storage block above.

It is in the boiling and simmering operations that the combination of storage and non-storage methods is of greatest value. High rated hot-plates required on non-storage cookers generate heat much more rapidly than the liquid to be boiled can absorb it, so that when the boiling point is reached the surplus heat is uselessly dissipated. It is not generally known that, for this reason, if the extra time is available, a 500-W hot-plate will boil a given amount of water with a consumption about 20 per cent. less than when the same operation is carried out on a 2,000-W hot-plate.

The present three-heat switching load graduations of high duty hot-plates are far too wide to secure continuous efficiency in operation, even with the recently introduced fourth regulation. With semi-heat storage more rapid boiling is achieved by placing the pan upon the super-hot surface of the heat storage block. It has been stated that a cast-iron hot block at a temperature of 550 deg. C. boils three pints of cold water in 1½ mins.; at 450 deg. C. in 2 mins.; and at 200 deg. C. in 8 mins. Even the last figure represents a time less than is often required by a high-duty hot-plate. But it is wasteful to allow a pan to remain upon the hot block once boiling temperature has been reached, and it is therefore necessary to remove it to a low-duty non-storage hot-plate of, say, 500 W maximum rating, which is preferably controlled by a four-way switch whereby the loading can be 500, 300, 200 or 125 W.

Investigations of automatic boiling controllers have shown that when three pints of water is left boiling on a 500-W hot-plate, approximately two-thirds of the heat is dissipated in the form of wasteful steam, and one-third is usefully employed in maintaining boiling temperature in the liquid. The amount of heat required to maintain boiling temperature will vary slightly according to the type and size of pan used, the ambient temperature, and the disposition of the hot-plate. Automatic boiling control is ideal from the economy point of view, but it has not been favoured by cooker manufacturers and others, hence the substitution of more finely graded switching applied to low rated hot-plates, which results in consumption rather lower than with automatic boiling, but substantially higher than that of hot-plates incorporating heat control in large steps.

Improved Load Factor

A cooker constructed and used as described will approximately halve the maximum demand of an equivalent non-storage cooker and also show a substantial saving in current consumption. Thus the fixed charges can be halved, and a much needed reduction can be made in the flat rate per kWh owing to the greatly improved load factor. Furthermore, existing distribution networks may be loaded with double the number of cookers, thus saving heavy outlay in additional cables and maintaining good pressure regulation.

If slow boiling or simmering is required the grill-boiler of a small cooker is used switched down to low load after boiling temperature is reached, instead of using the high duty hot-plate in like manner. This method confirms the lower efficiency of the grill-boiler, in that the lower heat required is brought about by some of the heat generated being dissipated in the air around the exposed element. The practice of using two pans on one hot-plate is also wasteful, and points to a disadvantage of the high-duty hot-plate. The difference in cost between two 6 in. 500-W hot-plates and one 8 in. 2,000-W hot-plate is insignificant, but the saving in energy with the former will be high when used in conjunction with a heat storage block and arranged for four-heat switch control.

Although electrically actuated thermal units are innately expensive, they can be more efficiently and safely applied to cooking and kindred purposes than heat produced by any form of direct combustion, and the methods outlined will secure electric cooking on economic lines.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Synthetic Rubber

I see that German chemists claim to have produced a synthetic rubber but fail to mention the cost. With the natural product at something like 5d. per lb. they will be hard put to it to produce a substitute at a comparable price.

But we have had many rumours of synthetic rubber discoveries from time to time. Edison experimented with hundreds of various plants to find a suitable latex and decided that the golden rod if properly cultivated was the most likely source. According to a recent biography by W. A. Simonds, Edison said on his 82nd birthday: "Give me five years more and the United States will have a rubber crop that can be utilised in twelve months' time."

Like several other matters with which the great inventor experimented as side lines the subject was apparently dropped. It would be interesting to learn whether his researches were pursued by any other workers. CAOUTCHOUC.

September 17th.

A Motor Control Problem

As a contractor in a rural area I frequently have to install domestic pumping sets fitted with motors up to about 1 h.p., controlled by a float switch and a straight-on-line contactor starter fitted with thermal overload releases on each phase—a fully automatic arrangement at a reasonable cost.

Section 7, paragraph 705, of the new I.E.E. Regulations, reads as follows:—

"Every electric motor shall be provided with an efficient switch or switches for starting and stopping, so placed as to be easily operated by the person controlling the motor; and every electric motor having a rating *exceeding* ½ *h.p.* shall be provided with (A) Means for automatically opening the circuit if the supply voltage falls sufficiently to cause the motor to stop. . . . (C) For alternating current motors, when the supply is obtained from an external source, a starter or switch limiting the starting and accelerating current to the extent (if any) required by the supply authority."

I am at a loss to know how I can still retain the fully automatic properties of float switch control at a reasonable cost and also comply with paragraph (A). This problem was raised recently when the installation inspector of a large electricity undertaking, the load of which is mostly provided by rural consumers, stated that it was against the Regulations, by which it abides to the very letter, to connect an installation fitted with a float-switch equipment and a ½-h.p. motor.

On my asking the advice of the head office of the undertaking I received a short letter pointing out the page and paragraph numbers of the Regulations, but giving no advice as to what apparatus was thought suitable to comply with the regulations. Incidentally a copy of this absurd letter was sent to my customer, whose electrical knowledge is nil, completely mystifying him and affecting our business relations.

I am aware that a comparatively expensive star-delta starter operated by float switch, can be obtained, but then would this comply fully with paragraph (A) as to no-volt protection?

What then does one do in the face of keen competition? Quote for the far more expensive star-delta fully automatic equipment and probably lose the job on the price alone, or tell customers that the pumping set will have to be started by hand and stopped only by the float switch, thereby losing the advantages of fully automatic control which certainly helps to sell more electricity?

September 15th. RURAL CONTRACTOR.

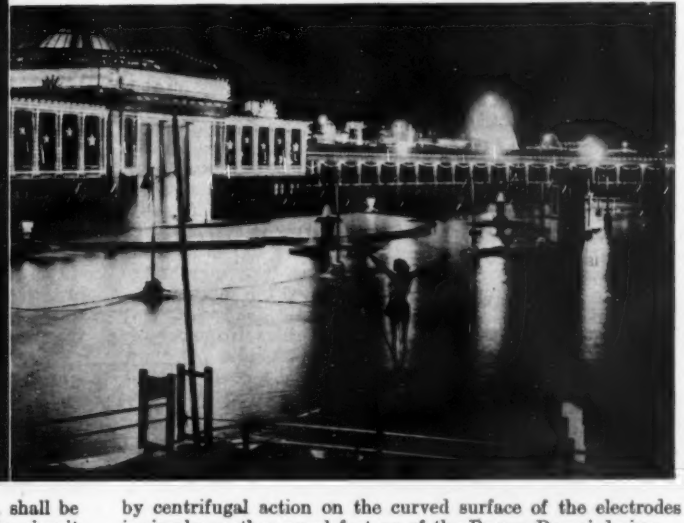
Electrode Water-heating

Mr. J. Eden, in his letter printed in your issue of September 6th, throws doubt upon the originality of the principle and construction of the new Brown Boveri electrode boiler. While it appears that the latter resembles in some respects the apparatus he describes, it is evident from Mr. Eden's description that the two designs differ in several fundamental respects, for example:—

(1) In the new boiler an earthed nozzle is used so that there is no porcelain in water. (2) In it a novel arrangement of the electrodes is used to ensure that the water jets, both to and from the electrodes, remain continuous streams and do not break up into drops due to splashing. (3) It utilises a constant (double) jet length and direction, regulation being by varying the number of jets and not also the length, as in the boiler referred to by Mr. Eden. (4) The new boiler is a success, whereas we gather from Mr. Eden's letter that the one he describes was not.

We do not consider that any inference is to be drawn from the original article in disparagement of ordinary immersed electrode boilers. The separation of the steam from the water by centrifugal action on the curved surface of the electrodes is simply another novel feature of the Brown Boveri design.

BRITISH BROWN-BOVERI, LTD.,
B. WOOD,
London, S.W.1, *September 17th.* (*Contract Department*).



It is becoming a commonplace to say each autumn that "this year's Blackpool illuminations are better than ever." The lighting now to be seen is on even more lavish and ingenious lines. One of the "set pieces"—Aladdin and his Princess—is illustrated on the left, while the other picture shows a well-illuminated bathing pool backed by buildings outlined in lamps and floodlighted

Patchy Street Lighting

In commenting last week on the papers read at the conference of the Association of Public Lighting Engineers, you referred to the traffic dangers due to inadequate road illumination. It should be emphasised that in the London area, and in other large groups of towns also, the inadequacy consists in lack of uniformity almost as much as deficiency of candle-power. Every motorist knows the dangerous period when passing from the area of one local authority to another before his eyes can adapt themselves to the enormous variations.

This variation may not always be a question of £ s. d.; it may sometimes be merely an inability on the part of public bodies to grasp that traffic conditions to-day demand something not only better but radically different from what was regarded as meeting the requirements of safety a few years ago. There should be a standard of uniform illumination for roads of the same class as well as the reorganisation of the financial aspect of road lighting. STILB.

September 18th.

Discussions at Norwich

Some views on the B.A. electrical papers

DISCUSSING the papers read at the Norwich meeting of the British Association for the advancement of science (to which reference was made last week), Prof. W. Cramp suggested with regard to the paper on "Incremental Magnetism," by Dr. L. G. A. Sims, of Birmingham University, that Section G. (Engineering) of the B.A. should first obtain views as to what should be done to specify tests for transformer iron. Then the whole matter should be brought to the notice of the British Standards Institution.

Prof. G. W. O. Howe, who together with Dr. J. L. Miller and Prof. E. W. Marchant agreed with this suggestion, added that it was also advisable to obtain international agreement, although it would probably take some time to do so. Prof. F. G. Baily thought it might be necessary to have two specifications, leaving designers to decide which to make use of.

Dealing with Dr. J. L. Miller's paper on "Surges in Transmission Lines and Transformers," Prof. G. W. O. Howe expressed the view that it was just as dangerous to remove a voltage suddenly from a transformer as to apply one suddenly. Prof. E. W. Marchant, remarking that no more complete investigation of this subject had been made, to his knowledge, mentioned the importance of it in districts like Johannesburg where thunderstorms occurred on about 150 days a year.

Prof. W. Cramp, after agreeing that the most satisfactory method of dealing with this problem was by flattening out the wave front, called attention to the "Thyrite" lightning arrestor in which the conductivity varied according to the pressure. If the pressure were doubled the current would be increased 12.6 times. The resistance was reinstated automatically so that it was not possible for there to be a follow-up of the 50-cycle current.

Dr. J. L. Miller, in a brief reply, said that the credit for this work was really due to Messrs. Ferranti, Ltd., in whose laboratories much expensive research had been carried out with the object of improving the performance of transformers. Although "Thyrite" was a remarkable substance, it had the disadvantage, as had all such devices, that it could not carry the current arising from a direct stroke.

Dielectrics at High Frequencies

The paper on "Dielectrics at High Frequency" was introduced by Prof. E. W. Marchant, under whose supervision the investigations are being carried out. The difficulty of finding an oscillator to generate the required frequencies with sufficient power had eventually been overcome, but the difficulties of measurements at such high frequencies still remained.

Notwithstanding the difficulties of measuring voltages of 10^7 cycles, Dr. B. A. Sharpe, a joint author, had designed a high-frequency voltmeter of a simple form in which there was a suspended rod about 2 in. long with a sphere at each end. Each sphere was inside a ring, the two rings being electrically connected to form one pole of the instrument, the rod and spheres forming the other pole. The capacity of the instrument was about $2\mu\mu$ F and it had a frequency of 10^7 cycles per second at a voltage of 500, the current being about 0.6 A. It was necessary to employ a mercury contact owing to this current being too heavy for the suspension filament. A simple substitution method had proved more satisfactory for measuring the power losses than electrostatic wattmeters and bridge methods.

Prof. W. Cramp spoke of the difficulty which a University or technical college had in competing with the large research laboratories of commercial firms owing to the heavy cost of apparatus involved. Although this might be used, by some people, as an argument for the abolition of university laboratories he contended that this paper justified the university laboratory as covering a class of work which it was not to be expected manufacturers would undertake. Indeed, it was exactly the type of work which the universities were bound to undertake to an increasing extent as time went on. He stressed the importance of the application of the subject not only for telegraph and telephone cables, but also in connection with condenser design. If this paper indicated to manufacturers the best materials to use to obtain high permittivity for condensers and small permittivity for cables, it would be of very considerable value. Emphasising that permittivity must be affected by the thickness of the dielectric, Prof. Cramp suggested that while the curves obtained by the authors could be regarded as a general guide, he doubted if they actually represented the specific values that could be accorded to the material.

Prof. F. G. Baily also spoke upon the limitations of the laboratories of educational institutions and regarded it as unavoidable that their scope would have to be limited to bridging the gap between the physicist and the works. Referring to contacts made with vaseline and tinfoil, he said that the pressure applied made an enormous difference and at high pressures the merest film of vaseline might have a considerable effect upon the power factor. He disagreed with Prof. Cramp's views with regard to fibre. Although it might not be a good substance from the electrical point of view, it was mechanically very strong and was used by many manufacturers for this reason where its hygroscopic properties did not have any great influence.

Prof. L. S. Palmer remarked that little had been said with regard to the difficulties of measuring at frequencies corresponding to a wave length of, say, 3 metres. Prof. G. W. O. Howe expressed the view that round wires were the ideal form of resistance to adopt from the point of view that the cylindrical form was the only one which permitted of calculation. With ceramic materials in Germany investigators had obtained enormous permittivity. Moreover, with these substances he believed a material with a specific permittivity could be obtained as desired.

Prof. Marchant, in reply, said that not only was it hoped to investigate ceramic materials later, but a certain amount of work had already been done on three organic acids, although the paper did not refer to this.

Electricity Supply in South Africa

THE twelfth annual report of the Electricity Supply Commission of South Africa covers the year ended December 31st, 1934, but supplements that information with a brief review of activities up to the end of last May.

The Commission owns five undertakings and two more are under construction. Sales of electricity in 1934 amounted to 985 million kWh, an increase of 11 million kWh over 1933, but this advance does not truly reflect the true position, as the 1933 figures included 44 million kWh supplied to Cape Town Corporation on interchange. The figures for 1934 do not include the kWh taken by the Corporation from the pool under the agreement which superseded that in force in the previous year.

The net total capital expenditure at the end of last December was £9,137,000, of which £863,000 was incurred during the year. Revenue received was £1,184,000, and working costs amounted to £1,172,000, the Act of 1922 providing that as far as practicable the undertaking should be carried on without profit or loss. In addition to a loan of £6,750,000 issued in March, 1934, a public loan of £2,500,000 was raised in November to finance the new Klip and Rand Extension undertakings.

The Klip generating station (near Vereeniging) with 139.000 kW of plant is expected to be ready for operation about next February. The licence for the system of the Rand Extension has been ceded to the Victoria Falls and Transvaal Power Co., Ltd.

An extension of the electrified railway system from Darinana to Harrismith was put into service in February, 1935, and further extensions have been started from Cato Ridge to Durban and Glencoe to Volksrust. Electrification of the suburban railways along the Reef is in hand, and eight rectifier traction sub-stations are to be provided by the Commission for the S.A. Railways and Harbours administration.

The average cost per kWh sold for all classes of consumer was less than in the previous year and the output this year promises to be substantially in excess of that for 1934.

Particulars of the power stations are as follows, the figures being on a sent-out basis:—

Undertaking.	kW. installed.	kWh. millions.	Load factor, %.	Thermal efficiency.	Coal per ton.
Natal Central (Colenso)	60,000	140	49.2	17.4	10s. 9d.
Witbank	100,000	690	77.4	16.3	2s. 3d.
Durban (Congella) ...	68,000	141	43.1	19.0	15s. 4d.
Cape Town (Salt River)	70,000	192	54.3	18.9	25s. 6d.
Sabie (hydro)	1,350	8	72.2	—	—
Total ...	299,350	1,171	—	—	—

Traction accounted for 146 million out of the total of 985 million kWh sold. Bulk supplies, including the whole of the Durban load and all but one-tenth of that of Witbank, amounted to 750 million kWh. Industrial and mining requirements absorbed 86 million and domestic and lighting 3 million kWh. The staff consisted of 422 Europeans and 284 non-Europeans.

During the year the Commission reported on six new and thirteen extensions of municipal electricity supply schemes and on six tenders for schemes. The total number of such schemes at December 31st was 266, of which 110 were new, and 122 were tenders.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Watertight Bulkhead Fittings

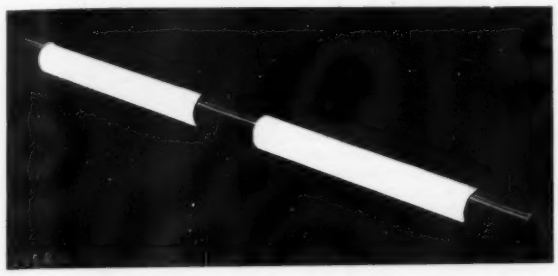
The new R.E.A.L. watertight fitting with reflector

Pressed steel watertight bulkhead fittings are the latest development by ROWLAND'S ELECTRICAL ACCESSORIES, LTD., R.E.A.L. Works, Hockley Hill, Birmingham, 18. The advantages claimed for these fittings are that they are three times as strong as the cast-iron type, yet they are only one-third of the weight and cost the same.

Our illustration shows a 60-W reflector model, and both 40/60-W and 75/100-W sizes are available with or without reflector, with enamel or galvanised finish, and with or without a guard. The lampholder is of porcelain.

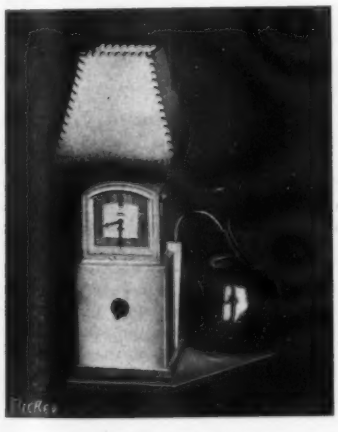
Architectural Strip-lighting

New architectural strip-lighting produced by LINOLITE, LTD., 96, Victoria Street, London, S.W.1, is in the form of decorative tubular lighting, comprising "Linolite" lampholders mounted on a channel with chromium-plated sleeves between the lamps.



A new "Linolite" fitting

The standard lamps are 284 mm. long and are obtainable opalised, frosted or colour sprayed. The strip thus combines the advantages of "Linolite," by which individual lamps of standard length can be used, and of continuous strip. The chromium sleeves house porcelain lampholders.



The new "Tecal"

The New "Tecal"

A redesigned model of the already well-known "Tecal," a product of MESSRS. DRAKE & GORHAM WHOLESALE, LTD., 77, Long Acre, London, W.C.2, has been introduced. As previously, it automatically makes two cups of tea at a time predetermined by the setting of the alarm clock.

When the tea has been infused the kettle is switched off, the table-lamp turned on and an alarm sounded.

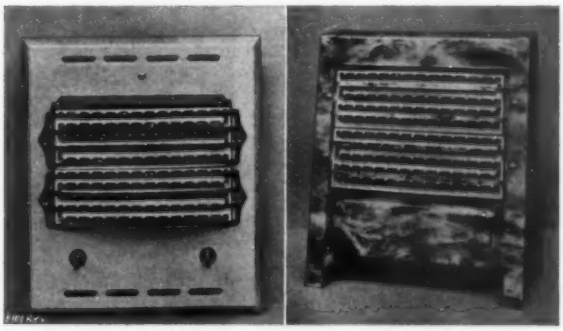
A washable cellulose finish is now employed for the outfit, and the kettle has a capacity of 2½ pints.

Electric Fires

A number of new electric fires have been introduced by the ENGLISH ELECTRIC CO., LTD., Stafford, including a low-priced inset fire (HH. 143) made in 1- and 2-kW sizes. It is of simple design, the front frame being of close-grain cast-iron finished in "rainbow" or "sunrise" vitreous enamel and fixed by a single screw to the back cover.

Each element is independently controlled and protected by a sheet metal back. For fitting the fire a recess of 12¼ in. by 12½ in. by 2 in. is required.

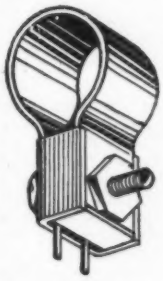
A new cheap line in electric fires is the No. HH. 141, an exceptionally strong pressed steel design available in stoved-enamel or chromium-plate finish. In general design it follows conventional lines for this type of fire, the elements being of the horizontal spiral type in a vertical plane fitted with the usual guards. The employment of pressed steel has reduced the weight of this type of fire considerably.



The English Electric models HH. 143 and 141

An Earth Clip

The "Knock-out" earth clip which has just been introduced by MESSRS. LONGBOTTOM & CO., Lawkholme Lane, Keighley, has lugs which are totally enclosed to prevent any dirt, grease or corrosion forming and making a bad earth; this is an important feature, since earth clips are seldom examined once they have been fitted. Types for both conduit tubing and lead-covered cable have been made available.



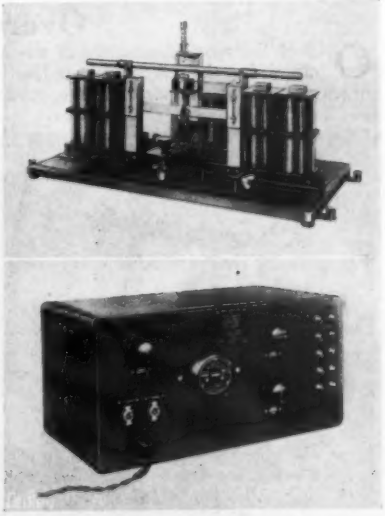
A "Knock-out" earth clip

Flameproof Contact Suspension Gear

For use in conjunction with flameproof lanterns employed in oil refineries the LONDON ELECTRIC FIRM, Brighton Road, South Croydon, has introduced a new form of contact suspension gear. The usual suspension element is embodied and concentric ring contacts are used. The regulation clearances between the fixed body and moving plug are observed, and an interesting point is that there is virtually no "void" in the interior, so that there is practically no space in which gas can collect. The terminal box is arranged for filling with compound in the usual way.

An Electro-magnetic Fatigue Tester

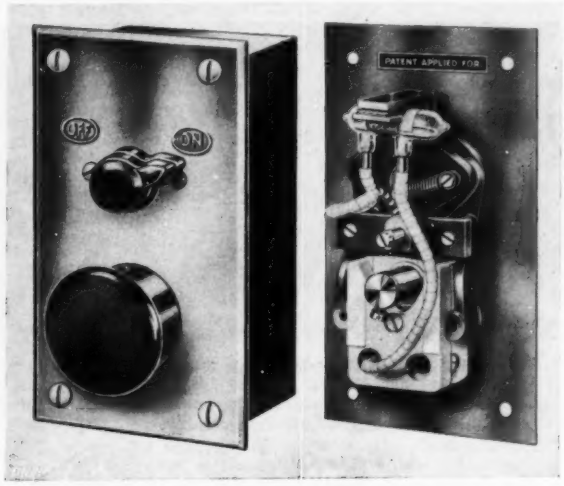
A new type of fatigue life tester for sample steel bars which can also be adapted for testing non-magnetic metals has recently been developed by SALFORD ELECTRICAL INSTRUMENTS, LTD., Silk Street, Salford. The sample bar or rod is supported at its two nodes and vibrated electro-magnetically so that it resonates, a method that allows a large number of cycles of stress to be applied to the bar in a relatively short time. By measuring the deflection of the bar at an antinode the actual stress applied can be calculated; the number of cycles applied to the test bar before failure can be indicated by a recorder. Means of tripping the whole gear is provided to operate on the occurrence of a crack in the specimen. More than one bar may be vibrated at once by providing several units, and the different failure times caused by varying the stress on each can all be indicated on the chart of one recorder.



The electro-magnetic fatigue tester: (Above) the bar holder and electro-magnets and (below) the power supply unit

The complete apparatus comprises three parts, *viz.*, the bar holder and electro-magnets, the power supply unit, and the recorder.

The test bar is supported in "vee" notches and is rubber-covered at these points to obviate chattering due to the imperfection of the mechanical contact. For non-ferrous metals it is necessary to provide steel sleeves over the test bar in the region of the exciting magnets, and a small steel clip in the centre for the pick-up.



The Walsall "Sparkless" switch

A.c. is used, transformed for filament heating and rectified for the gasfilled relay anode and the d.c. polarising magnets. The electro-magnets for vibrating the bar consist of two pairs of coils on two iron circuits. One pair is excited by d.c. and provides a constant polarising field. The other pair is excited by a.c. from the gasfilled relay circuit, in which the relay, with its condensers and inductances, forms a variable-frequency oscillator which can be adjusted so that the electrical frequency corresponds to the mechanical natural frequency of the bar; when this occurs the bar resonates with a relatively large amplitude and is held in synchronism (vibrating at the same amplitude even when the applied voltage varies or the circuit constants alter slightly) by means of a pick-up under the centre of the bar, which is connected in the grid circuit of the relay.

To trip the circuit on a crack occurring an auxiliary vibrator is provided. This comprises a length of steel spring, the tension of which can be adjusted to vary the natural frequency, and is excited from the same circuit as the main a.c. coils; after tuning the main circuit the auxiliary vibrator is tuned by varying the tension and then detuned slightly by a half-turn backwards of the tension-screw, the natural frequency being thereby lowered so that no appreciable vibration occurs. A crack reduces the natural frequency, and the auxiliary vibrator then comes into action with an amplitude sufficient to touch a fixed contact; this closes a local circuit and short-circuits part of the resistance in the grid-filament circuit, causing the gasfilled relay to take an increased anode current, which trips a small circuit-breaker. The unit is thus shut down, and the corresponding pen of the recorder is lifted to indicate the point at which the particular bar has failed.

The recording drum is driven by a synchronous motor, supplied from the oscillator which vibrates the lowest stressed bar. The standard tester is designed for ½-in. round-steel bars 18 in. long, the natural frequency of which is between 250 and 300 cycles per second; modifications of distance between centres, &c., are required for other dimensions. The apparatus may also be adapted to deal with non-uniform loads and the application of a fixed bending load or torsion at the same time as the vibratory stress.

A Small "Sparkless" Switch

In the operating theatres of hospitals and other situations where explosive gases are present the standard type of q.m.b. switch, even if totally enclosed, can present an element of risk, and in any case it is undesirably noisy. For such positions WALSALL CONDUITS, LTD., Excelsior Works, West Bromwich, have introduced a "Sparkless" switch. It is of the rotary type, the movement of the switch handle operating a cam which tilts a small mercury tube, thus breaking and making the circuit through the mercury. The tube is mounted on a permanent bracket, the flexible connections from the electrodes in the vessel being connected to fixed terminals and being of sufficient length to allow the switch to be operated without undue strain. Five- and fifteen-ampère sizes are made, with or without a three-pin plug. A switch of this kind costs rather more than the standard type, but its advantages should be sufficient to outweigh this in the majority of cases.

A Combined Desk Lamp and Inkstand

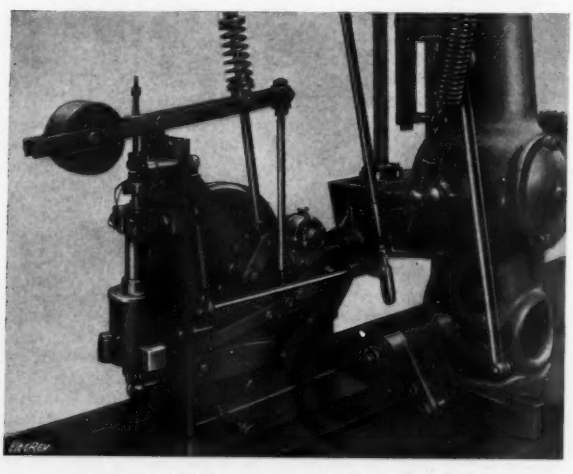
The "Cashlight" adjustable standard is not new, but it has now been incorporated in a neat desk lamp and inkstand; in this case, however, instead of the usual circular metal or porcelain base, the reflector, adjustable movement and stem are mounted on a massive rectangular bronze base, which is not attacked by ink.

The bronze casting carries two glass inkstands and is weighted with cast iron to give stability. The manufacturers are MESSRS. CASH WHITEHURST & CO., 85, Hatton Garden, London, E.C.1.

The "Cashlight" adjustable desk lamp and inkstand

Overwind Prevention in Mineshafts

ONE of the recommendations of the Mines Department for minimising the risk of overwinding in mineshafts strongly urges the use of auxiliary speed control equipment to reduce the speed during the last part of the retarding period to a maximum of 5 ft. per sec. for the final 3 sec. of the wind.



The Fraser & Chalmers "slow banking" device

In anticipation of these requirements Messrs. Fraser and Chalmers have developed a "slow banking" device that can be applied to any other standard types of overwind prevention gear. It is particularly suitable for driving from the well-known Whitmore overwinder, the standard trip gear being slightly modified and used in conjunction with a vertical trip rod having a slotted end to enable it to be operated either by the slow banking device or by its own overwind trip, according to circumstances. A crank and gear wheel are driven from the winding engine drum so as to make rather less than half a complete revolution for a complete wind. The crank pin engages with a hole in the end of the crank rod, which is elongated so that for the main part of its motion the pin travels idly without moving the rod in the direction of its length.

Towards the end of each winding operation the crank pin comes to the end of the slot in the rod and causes a dashpot to be raised through the linkages. Leverage between the rod and a dashpot gradually increases and the speed of the dashpot relative to that of the drum becomes increasingly greater. By this means a constant dashpot speed is derived from a decreasing drum speed, and by suitably shaping the cams any desired relation between drum speed and the position of the cages in the shaft can be associated with a constant speed of rise of the dashpot. If the drum speed at any time during the controlled part of the wind exceeds the predetermined value, a switch of the sealed mercury type causes an electric alarm to warn the driver to reduce speed, and if this is not done the further rise of the piston trips the overwinder, closing the throttle and fully applying the brakes.

British Overseas Electrical Trade

Satisfactory August figures

WE do not expect great industrial activity during August, the holiday month, and the fact that the value of electrical equipment shipped overseas, as recorded in the Board of Trade returns, was rather lower than in most other months this year is not disquieting. Comfort may be derived from the knowledge that the total of £1,008,829 was substantially in advance of the figure for the corresponding month last year, which contained an equal number of working days, namely, twenty-six. As will be seen from the table on the right the extent of the improvement was £119,743, equivalent to 13.5 per cent. Compared with July (twenty-seven working days) shipments decreased in value by £119,707, the falling-off being general to most classes of electrical goods and machinery exported.

At first glance it may be thought that the position with regard to imports was good, but in actual fact the total of £326,377 was the highest recorded this year, even though £20,776 (6 per cent.) less than in August last year. Unenumerated electrical goods (£63,527), lighting apparatus (£51,745), and vacuum cleaners (£27,208) were particularly high. The nature of these goods suggests that this increase is accounted for by domestic electrification. Although the bulk of the equipment is supplied by our own manufacturers, it is, of course, inevitable that imports should be affected in some measure.

Destinations of Exports

Turning to the analysis of our exports contained in the larger table, it will be seen that shipments of goods and apparatus amounted in value to £719,549, which is good for August, being higher than the amount for three of the preceding seven months of the year. Only four countries show a decrease on August last year. The chief destinations of the more important items in this section were as follows, the August, 1934, figures being given in parentheses :—

Rubber insulated wires and cables :—South Africa, £24,313 (£17,905); Australia, £21,105 (£21,233); British India, £14,221 (£13,550); New Zealand, £3,743 (£4,320); other British countries, £10,469 (£13,819); foreign countries, £10,289 (£6,655).

Electric wires and cables (insulation other than rubber).—South Africa, £28,493 (£18,854); Australia, £12,349 (£12,200); British India, £11,675 (£11,651); other British countries, £10,062 (£12,640); foreign countries, £12,484 (£8,801).

Telegraph and telephone apparatus (not radio).—Australia, £31,354 (£12,642); South Africa, £18,528 (£17,476); Argentina, £14,038 (£4,110); Canada, £1,968 (£469); other foreign countries, £44,661 (£31,621); other British countries, £11,102 (£12,129).

With regard to machinery, the value of generator exports, although less than in August last year, was the second highest recorded this year. Motors remained on the level of the past month or two. Other machinery exports were rather less than usual.

The values of imports from various countries, with comparative figures, were as follows :—

Electrical goods and apparatus.—United States, £85,825 (£87,520); Germany, £65,748 (£58,555); Netherlands, £32,676 (£72,782); Switzerland, £13,648 (£18,988); France, £9,695 (£16,058); Austria, £7,893 (£4,996); Belgium, £7,864 (£5,515); other foreign countries, £29,805 (£32,248); British countries, £11,992 (£14,522).

Electric vacuum cleaners.—Canada, £17,541 (£153); United States, £3,871 (£1,403); Sweden, £3,370 (£4,120); Germany, £1,060 (£317); other foreign countries, £1,366 (£973).

EXPORTS AND IMPORTS DURING AUGUST

	Exports. August, 1935.	Exports. Inc. or dec. compared with Aug., 1934.	Imports. August, 1935.	Imports. Inc. or dec. compared with Aug., 1934.
Submarine telegraph and telephone cables	—	— £6,463	*	—
Telegraph and telephone wires and cables (not submarine)	£26,039	+ 4,559	*	—
Other insulated wires and cables	159,203	+ 17,575	£17,590	+ £1,040
Radio receivers (not radiograms), excluding valves	24,798	+ 7,617	24,364	— 30,796
Radio transmitters (excluding valves)	18,053	— 6,109	*	—
Radio valves	52,190	+ 25,161	13,496	— 3,510
Other radio parts and accessories	41,576	— 3,147	62,230	— 15,922
Telegraph and telephone apparatus (other than radio)	121,651	+ 42,204	*	—
Electric carbons	*	—	7,922	— 6,837
Incandescent lamps	36,350	— 4,321	15,482	+ 5,883
Other lighting apparatus	32,544	— 1,505	36,263	— 5,891
Primary batteries	13,474	+ 271	387	— 603
Accumulators	39,130	+ 8,749	*	—
House service meters	11,396	— 583	*	—
Other electrical instruments	13,227	+ 1,191	23,885	— 1,453
Unenumerated electrical goods and apparatus	129,918	+ 17,250	63,527	+ 12,051
Electric generators up to 200 kW	26,419	+ 12,462	*	—
Electric generators over 200 kW	47,536	— 25,825	*	—
Electric motors	79,204	+ 20,896	14,908†	— 1,285
Convertors and transformers	34,675	+ 5,840	*	—
Starting and controlling gear for motors	26,715	— 77	*	—
Switchgear	66,364	+ 7,435	*	—
Other electrical machinery	8,367	+ 554	10,115	+ 6,305
Electric vacuum cleaners	*	—	27,208	+ 20,242
Total	£1,008,829	+ £119,743	£326,377	— £20,776

* Not separately classified. † Not railway and tramway motors.

For the first eight months of the year the value of our electrical exports was £8,481,636, compared with £6,928,991 in the corresponding period of 1934, representing an increase of 22 per cent. Imports amounted to £2,231,425, compared with £2,263,855, a decrease in the eight months of £32,430, or approximately one per cent.

BRITISH ELECTRICAL EXPORTS IN AUGUST

Destination.	Goods and apparatus, Aug., 1935.	Inc. or dec. compared with Aug., 1934.	Electric generators, Aug., 1935.	Inc. or dec. compared with Aug., 1934.	Motors, Aug., 1935.	Inc. or dec. compared with Aug., 1934.	Other electrical machinery, Aug., 1935.	Inc. or dec. compared with Aug., 1934.
Irish Free State	£40,262	+ £8,643	*	—	*	—	*	—
Union of South Africa	118,621	+ 11,069	£28,182	— £7,713	£31,381	+£21,151	£35,491	— £4,521
British India	80,225	+ 9,600	12,522	+ 4,806	11,142	+ 4,390	27,785	+ 6,084
British Malaya	13,613	— 501	*	—	*	—	3,937	+ 591
Ceylon	5,689	+ 391	*	—	*	—	*	—
Hong Kong	4,739	+ 2,058	*	—	*	—	*	—
Australia	100,047	+ 12,693	7,798	— 6,268	8,354	+ 2,084	8,993	— 1,953
New Zealand	35,638	+ 1,849	*	—	2,223	+ 86	8,430	+ 7,442
Canada	9,151	+ 2,975	6,664	+ 1,291	3,873	+ 727	1,777	+ 286
Other British Countries	46,209	+ 753	9,021	— 9,419	8,189	— 4,777	18,117	— 745
Sweden	14,466	+ 5,052	*	—	*	—	*	—
Denmark	20,092	+ 8,688	*	—	*	—	*	—
Belgium	14,131	+ 4,108	*	—	*	—	*	—
France	19,059	+ 9,431	*	—	*	—	1,797	— 531
Spain	13,644	— 2,838	*	—	*	—	*	—
Italy	3,869	+ 1,653	*	—	*	—	*	—
Greece	3,406	— 1,513	*	—	*	—	*	—
Egypt	12,211	+ 3,429	*	—	*	—	357	— 2,178
China	10,734	+ 2,281	*	—	*	—	4,790	+ 130
United States	1,364	— 1,129	*	—	*	—	*	—
Argentina	28,042	+ 12,366	*	—	352	— 187	671	— 253
Soviet Union	*	—	—	— 40	1,258	+ 1,255	2,532	+ 2,532
Netherlands	*	—	149	+ 93	*	—	669	+ 109
Other Foreign Countries	124,337	+ 7,391	9,619	+ 3,887	12,432	— 3,833	20,775	+ 6,768
Total	£719,549	+£98,449	£73,955	—£13,363	£79,204	+£20,896	£136,121	+£13,761

* Not separately classified.

Italian Electrical Trade

The imports of foreign electrical machinery and cognate material into Italy during the five months ended May last amounted to £744,850 (£=60 lire), as compared with £596,117 in the corresponding five months last year. There was a decline from £280,266 to £264,266 during the same period in the exports of similar material.

New Books

The Modern Diesel. Pp. 228; illus. London Iliffe & Sons, Ltd. Price 3s. 6d.

This valuable little book was first published in 1932 and it is a tribute to its usefulness that in so short a time a third edition should be called for. It is also, of course, a tribute to the rapid progress of the high-speed compression-ignition engine; for whereas in the first edition 141 pages sufficed to cover the various types then in commercial use the present edition requires 228 pages in order to be thoroughly up to date.

For those who are unfamiliar with the earlier editions it may be mentioned that the first part comprising six chapters is devoted to a general survey of the theory and practice of high-speed Diesel-engine design, a historical survey being followed by a description of the cycles of operation available, viz., four-stroke or two-stroke. This is supplemented by chapters dealing with what may be regarded as the two most important details of the design, i.e., the fuel-injection system and the cylinder head. A chapter on heavy-oil fuel suitable for this type of engine completes the first section of the book. The second part comprises a description of the various makes of high-speed Diesel engine, both British and Continental, these being arranged alphabetically. Particular attention is paid to the peculiar features of each design and sectional drawings, and detailed illustrations are lavishly employed to assist in the understanding of the text. Finally, the various makes are classified according to the nature of the service for which they are designed, whether for transport on land (road or rail), for marine service, or for aircraft.

We commend this book to all who are interested in the development of the high-speed Diesel engine. While the compilers are here concerned with the engine only, the subject has its peculiar interest for the electrical engineer in view of its increasing use in conjunction with the electric drive both for rail cars and for ships. Further, the high-speed Diesel engine is being increasingly used in the generation of electricity, where relatively small outputs of the order of 50 kW are required. A comprehensive index (a welcome improvement in the new edition) facilitates reference to the various types of engine now on the market.

Generating Stations. By A. H. LOVELL. 2nd edition. Pp. 438, illus. London: McGraw-Hill Publishing Co. Price 27s.

Since the original issue there has been remarkable developments in the application of the mercury vapour-steam cycle, improvements in internal combustion prime movers and in American hydro-electric practice. The last five years also has firmly established high-voltage long distance transmission, while new circuit-breakers and high-speed relays have been introduced into power interconnection systems. On the economic side increased values have accrued to the domestic load. These are among the later developments of Prof. Lovell's subject, and they are given full consideration in this work which particularly deals with the economic elements of electrical design.

The author says "The cheapest power is not necessarily produced by the most efficient plant which generally involves a higher first cost than would acquire a less efficient plant. The difference between real engineering and mere technical selection lies in the scientific proportioning of investment and operating cost." That is the keynote of Prof. Lovell's book which deals very thoroughly with most of the power engineer's major problems. An early section treats of the principles of corporate finance. Then the cost of stations in America and the savings due to interconnection are studied. It is shown that during the past eight years the financial emphasis has shifted from the power plant to transmission and distribution.

Power-plant load curves are exhaustively analysed in an early chapter and the ever-new problems connected with economic conductor sections are discussed. The influences which determine the situation of stations are outlined and chapters are devoted severally to current-limiting reactors, oil circuit-breakers and protective relays.

The book is adequately illustrated with photo blocks and after the fashion of such American text books a set of problems without answers is attached to each chapter. The author is Professor of Electric Power Engineering in the University of Michigan.

Energieubertragung und Umwandlung mit Wechselstrom. By DR. ING. PAUL WERNERS. Pp. 204; figs. 208. Leipzig: B. G. Teubner. Price 18 RM.

Energy transmission and transformation by alternating current which form the subject matter of this book have been dealt with by numerous authors in the principal European languages. Dr. Werners has undertaken the task of presenting the subject and its component parts in a uniform manner. He has also endeavoured to ensure that the wastage of mental energy by his readers shall be the minimum.

He first deals generally with the solution of a.c. problems and gives a summary of the mathematical equipment required for this. The "T" connection is then analysed in detail for single-phase working and extended to polyphase applications. Thereafter the homogeneous conductor, the single and three-phase transformer, asynchronous and synchronous machines, polyphase outdoor machines and regulating machines are analysed.

Throughout the book fundamental principles are rigidly followed, practical construction being entirely omitted. Numerical illustrative examples are, however, included which materially assist in relieving the stress of reading this somewhat difficult volume. The printing and figures are up to the usual excellent Teubner standard. There is a good index, and the book can be safely recommended.

Photo-Electric Cell Applications. By R. C. WALKER and T. M. C. LANCE. Pp. 245; figs. 142. London: Sir Isaac Pitman & Sons, Ltd. 2nd Edition. Price 8s. 6d.

The first edition of this book, in which was included much useful work that had appeared in the *Wireless World*, dealt with most of the avenues along which the photo-cell had been practically or commercially exploited to that date. The continued progress in the construction and use of both types of photo-electric cell is well known, and constitutes an ample excuse, and indeed need, for a second and more exhaustive edition, which the authors have supplied. Two important advances in photo-cell construction, the rectifier cell and the mercury vapour relay—in the form of the thyratron—would alone have justified the revision of the original book, which contains a considerable mass of practical information and descriptive matter clearly dealt with and well illustrated.

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Shorter Notices

"Modern Radio Communications. Vol. II," by J. H. Reyner. Pp. 165; figs. III. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d.

"Impregnated Paper Insulation," by J. B. Whitehead. Pp. 221; figs. London: Chapman & Hall, Ltd., Price 20s.

"Edison: His Life, His Work, His Genius." By W. A. Simonds. Pp. 364, illus. London: George Allen & Unwin, Ltd. Price 10s. 6d. net.

New Zealand's Electrical Imports

THE following statement showing the values last year of the imports of electrical goods into New Zealand is based on the official returns of the Dominion, and notes of increases or decreases compared with 1933 are added for purposes of comparison. It will be seen that the United Kingdom is still by far the largest supplier; Australia's continued competition in certain lines is noteworthy. Trade with the United States was well maintained, particularly in the radio section.

The recovery shown by electrical imports last year was maintained well into 1935, the total value of those of machinery and equipment in the first five months being £520,586 as against £357,356 in the corresponding period of 1934, but imports of wireless apparatus were only £124,000 in value as against £137,000.

	1934. £(000)	Inc. or Dec. £(000).
Batteries and cells—		
Total	151	+ 8
From United Kingdom	47	− 8
,, Canada	37	+ 8
,, United States	9	+ 7
,, Australia	57	+ 3
Insulated cable and wire—		
Total	146	+ 43
From United Kingdom	137	+ 41
,, Holland	2	—
,, United States	2	+ 1
Filament lamps—		
Total	145	+ 22
From United Kingdom	134	+ 22
,, Holland	3	+ 1
,, United States	6	—
Other electric lamps—		
Total	18	+ 2
From United Kingdom	7	+ 1
,, Germany	2	—
,, Japan	5	—
Electric ranges—		
Total	21	+ 12
From United Kingdom	15	+ 13
,, Canada	6	—

	1934. £(000)	Inc. or Dec. £(000).
Radio receiving sets—		
Total	115	+ 34
From United Kingdom	30	+ 11
,, Canada	5	+ 3
,, United States	70	+ 14
,, Australia	10	+ 6
Other radio apparatus—		
Total	249	+ 42
From United Kingdom	54	+ 7
,, Holland	11	+ 6
,, United States	131	+ 32
,, Australia	41	− 9
Other telegraph and telephone apparatus—		
Total	25	+ 11
From United Kingdom	18	+ 8
,, United States	5	+ 3
,, Australia	1	—
Carbons for electrical purposes—		
Total	23	+ 8
From United Kingdom	10	+ 6
,, Australia	9	+ 1

	1934. £(000)	Inc. or Dec. £(000).
Other electrical apparatus (duty free if British)—		
Total	251	+ 43
From United Kingdom	166	+ 10
,, Canada	7	+ 5
,, Germany	7	+ 2
,, Sweden	6	+ 1
,, United States	41	+ 18
,, Australia	18	+ 4
Other electrical apparatus (dutiable)—		
Total	67	+ 16
From United Kingdom	43	+ 13
,, Germany	1	− 1
,, Canada	4	− 2
,, United States	5	+ 2
,, Japan	2	—
,, Australia	11	+ 4
Motors—		
Total	73	+ 21
From United Kingdom	46	+ 4
,, Germany	1	—
,, United States	18	+ 13

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Gas on the Defensive

Mr. T. Carmichael, engineer and general manager to the Portsmouth Gas Company, read a paper on "Promotion of Gas Sales" at the annual meeting of the North British Association of Gas Managers at St. Andrews on September 12th. He said it was well known that the Electrical Development Association had in view a campaign for the autumn and winter seasons which was to be more ambitious and more prolonged than any previous national effort organised by the Association. In the face of this impending attack the gas industry must act decisively and unanimously. There was no doubt that the use of electricity would continue to increase, and as the gas industry would feel the effects of intensified competition, each individual undertaking must realise the necessity for taking suitable counter-measures. Gas sales in the United Kingdom during the last two years had shown a slight decrease, and it was of vital concern to the well-being of the industry that effective methods should be employed, which would not only arrest this decline but which would lead to an increase in business and to greater possibilities in the future. Referring to the decreased consumption of gas, Mr. Carmichael said that the customer changed to electricity, not because he was dissatisfied with gas lighting, but because he must have electricity for the all-mains wireless set. It was his opinion that if they were to hold and extend their sales in the face of keener competition, success would only be achieved provided, among other things, that their commodity was offered at prices which would secure business and that their service after sales was 100 per cent. efficient.

New Showrooms for West Hartlepool

West Hartlepool Corporation Electricity Department has opened new offices and showrooms in Church Street. Electra House, as the new premises are called, is a three-storey building which will accommodate the whole of the clerical and administrative staff as well as the domestic and other apparatus displays.

An Important Cardiff Venture

The Cardiff City Council has decided to accept the offer of a London syndicate to carry out a scheme for a large public hall, exhibition hall and sports arena in the city at a cost of about £250,000. The necessary finance will be provided by the syndicate which will hand over the undertaking to the Corporation in forty years' time.

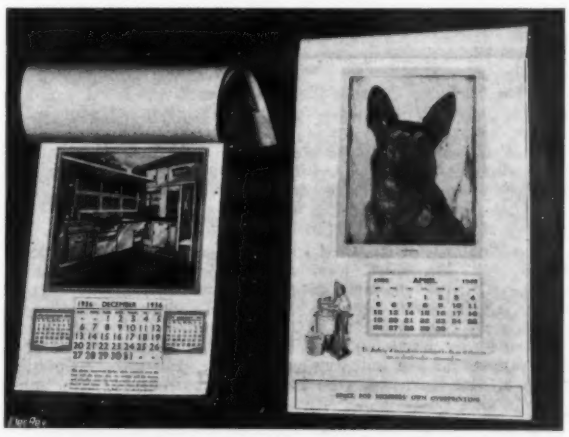
Extra Rates for Electricity

At East Lothian Valuation Appeal Court at Haddington on September 13th a house-owner appealed against the assessment of £1 in respect of introduction of electric light into his house. He quoted a decision given at the Court last year when an owner-occupier of a house successfully appealed for a reduction in the valuation of his house which had been increased on account of the electrical installation. The Assessor said if electric light was desirable—and it was desired by the public at large, as he could prove—then it logically followed that a tenant would pay more for a house having electric light than one without it. If they had two similar houses, one having electric light and the other without it, which would command a higher rent? That was what the Court had to consider. Of 179 letting subjects in the county, sixty-seven had had electric light installed, and as a result the landlord had increased the rent. He thought it was fairly conclusive evidence that where a landlord installed electricity the tenant was willing, or had, to pay additional rent. The reason why electric light was installed in houses and why this fact was advertised was because it was a desirable service and improved the market value, whether the dwellings were let or for sale. The Court dismissed the appeal.

"Osram" architectural lamps provide a pleasing decorative effect at the Chiltern Court Restaurant, Baker Street Station, London

E.D.A. Calendars for 1936

Reproductions of two attractive calendars for 1936 appear on the cover of the British Electrical Development Association's sales and publicity programme for October. One design has for its illustrations a series of black and white sketches depicting some of the most popular dogs, underneath the calendar itself being hints as to the numerous uses to which electricity can be put. In the "Wizard in the Wall" calendar coloured illustrations (from the film of that title) trace the history of electricity from its "discovery" by Thales two thousand years ago to its manifold applications to-day. The prices quoted by E.D.A. include the cost of envelopes and members' own special overprinting in the spaces provided. Also contained in the October sales and publicity programme are details of new posters, display boards and some of the E.D.A. campaign advertisements which have been adapted for small spaces.



The "Wizard in the Wall" and "Popular Dogs" calendars for 1936, produced by E.D.A.

Australia Buys More

A 50 per cent. increase took place during the financial year ended with June last in the value of the imports of electrical machinery and appliances into Australia, their total in round figures being £2,434,000 as compared with £1,622,000 during 1933-34. Imports of cable and wire rose in value from £454,200 to £646,600; dynamo-electric machines from £181,600 to £285,000; filament lamps from £131,600 to £213,500; telegraph and telephone material from £114,000 to £219,000, and unspecified electrical material from £720,000 to £1,045,000, while the trade in batteries and accumulators, which is now small, showed a slight advance, from £20,300 to £24,500.

A Hydro-electric Undertaking's Rates

In the Valuation Appeal Court, Fort William, on September 10th the North British Aluminium Co. and the Lochaber Power Co. were unsuccessful in their appeals against the Assessor's valuation, and they asked for a case to be stated so that the points in dispute might be decided by the Valuation Appeal Court, Edinburgh. It was explained that the present valuation of the Lochaber Power Co. was £6,750 gross, and that of the North British Aluminium Company's factory £825, so that the total valuation was £7,575. The rateable valuation of the two came to £1,725. The Assessor proposed to value the Power Company at £187,645 gross, and the factory at £8,772 gross, a total of £196,417, the rateable value to be £46,000. The appellants proposed a figure of £17,600 allocated as between the Power Company £16,000 and the factory £1,600. It was stated that the new figure on which the Lochaber works were rated represented more than half the amount of the whole landward area of the county. The new assessment which was objected to is based on the contractor's principle, a percentage of the capital value of the works. Mr. W. Murray Morrison, managing director of the British Aluminium Co. (which promoted the Lochaber Water Power Act) stated in the witness box that if the enormous sum of £23,785 which they were asked to pay in rates were insisted on, it would mean the end of hydro-electric development in the Highlands and an increase of £3 per ton on aluminium, making it impossible for them to compete in the

open market. The Assessor said that the valuation had been arrived at on the contractors' principle of 5 per cent. against lands, 7 per cent. against buildings, and 7½ per cent. against machinery. These were the recognised figures for business premises. An allowance of 20 per cent. was made in respect of those buildings which were erected after the war and which were accordingly more costly. He was prepared to take an overall percentage of 4 per cent., a gross valuation of £135,044. He did not think the revenue principle could be applied to a firm which could not be regarded as a public supply company. Counsel for the County Council said the Aluminium Company must be taken separately from the Lochaber Power Company. It was enjoying the advantage of extremely cheap electricity. The Council was not prepared to believe that if the assessment stood the company would have to close down. Lochiel, K. T., who presided, in giving the decision of the Court, upheld the claim of the County Assessor for £135,044 gross valuation making a rateable value of £31,650 for the Lochaber power works and £8,772 gross valuation, with rateable value of £2,056 for the Aluminium Co.

Carnival Displays

At a carnival held at Trowbridge, the second prize in the class for tradesmen's turnouts was awarded to the West Wilts Electric Light & Power Co., Ltd., for a display demonstrating electric cooking.

At the Barking Carnival last Saturday a decorated van by Messrs. Evans & Shea attracted much attention. Underneath very realistic imitation pylons was a display of Falk, Stadelmann & Ismay products which included a cooker, wash boiler, ironclad switchgear and radio apparatus. A placard invited spectators to "Enjoy both Leisure and Pleasure."

Public Utilities and Coal Prices

At a luncheon of the Coal Industry Society held in London, on Monday, Mr. R. A. Burrows gave an outline of the Lancashire Central Selling scheme which is being operated by an organisation bearing the title Lancashire Associated Collieries. The object of the scheme, which has been sanctioned by Parliament, is to improve the position of the coal miner and the industry as a whole. Referring to public utilities, Mr. Burrows, who is deputy chairman of the Lancashire Associated Collieries, said that they had practically a monopoly except for the competition between gas and electricity, which probably was very severe. These two industries could not, however, expect to take away from the coal industry the house coal market and supply gas and electricity in its place and then to buy coal at less than the cost of production. He felt that they talked rather loudly about monopoly in the coal trade without regarding the conditions in which they found themselves. He believed there was such a thing as a gas-coke ring around London and that the manufacture of electric and gas fires and other apparatus was in the nature of a ring, and therefore the coal industry was not introducing anything very novel in its central selling scheme. The only real opposition in Parliament has been from the public utilities and he was sure that when they realised the facts they would wish to help rather than hinder.

A Derby Exhibition

Over forty years of electrical development are marked by the Derby Local Government Centenary and Industries Exhibition which was opened yesterday and continues until September 28th. In addition to the Corporation Electricity Department's stand there are electrical exhibits by the Simplex Electric Co., Ltd. ("Creda" cookers), Hoover, Ltd., Wilkins & Mitchell ("Servis" electric washers), British Vacuum Cleaner and Engineering Co., Ltd., Hotpoint Electric Appliance Co., Ltd. (cookers), Santon, Ltd. (water heating appliances), Jackson Electric Stove Co., Ltd. (cookers and wash boilers), British National Electrics, Ltd. (cookers, washing machines and water heaters), Burnley Components, Ltd. (wash boilers), Beatty Bros., Ltd. (washing and ironing machines and drying cabinets), Heatrae, Ltd. (water heaters), Revo Electric Co., Ltd. (electrical appliances), and Macintosh Cable Co., Ltd. Derby's first generating machine of approximately 600 h.p. was operating in 1894 for private and public street lighting, and from this small beginning has grown up the present station with a capacity 100 times larger than the original installation. The most striking feature of the electrical development in recent years has been the large increase in the use of electricity for domestic purposes, and there are now in use in Derby cookers, wash boilers, water heaters, radiators, kettles, irons, toasters and vacuum cleaners totalling 38,000. The amount of electricity sold for domestic purposes has increased from 1¼ million kWh in 1925 to 5 million kWh in 1930, and 13¾ million kWh last year.

Colour Lighting Demonstration

Yet another sign that winter is near was the holding of the first Holophane lighting demonstration of the season in the company's comfortable Elverton Street, Westminster, theatre on Tuesday afternoon. A fair-sized audience listened with interest to Mr. R. Gillespie Williams, chief colour engineer, and watched a remarkable sequence of lighting effects produced on the stage. It was shown that the cost of stage scenery can be substantially reduced owing to the various effects obtainable with different colour combinations. The new "moulded contour" and "auto-selective" systems embodied in a recent installation at Swindon were also demonstrated and explained. We learned that the company is now engaged upon a larger number of installations than ever before, the colour lighting system being applied not only to dance halls, cinemas and theatres but to shop windows and hotels.

Works Visit

At the invitation of the directors of the London Electric Wire Company and Smiths, Ltd., about forty members of the Croydon branch of the Electrical Association for Women visited the company's Leyton factory on the afternoon of September 10th. The chairman of the branch, Mrs. F. N. Rendell-Baker, and the hon. secretary, Mrs. Stanley, accompanied the party. After an inspection of the factory, the party assembled in the staff canteen, where Mrs. McLeod, in a short speech, expressed the pleasure of the members in having had an opportunity of examining the interesting manufacturing processes. Mr. Ernest Leete, managing director of the company, responded.

Members of the E.A.W. at the London Electric Wire Co.'s Factory

X-Ray Examination of Welds

Philips Industrial, 145, Charing Cross Road, W.C.2, is offering to purchasers of its welding electrodes the free X-ray examination of a welded test piece produced by their means. Full particulars of the offer are contained in a pamphlet recently issued by the company.

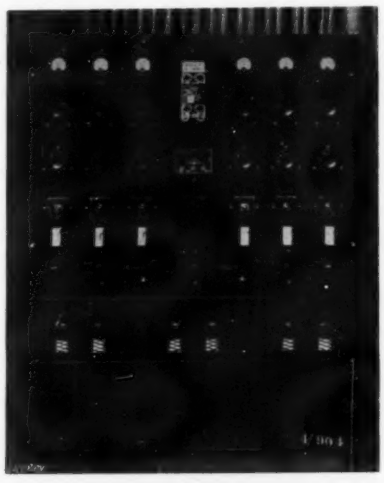
Orders Recently Booked

All Saints' Church, Elm, Norfolk, has recently been electrified by Messrs. F. G. Gossling, of Wisbech. The supply is generated by a Lister 4½-h.p. engine and generator. The lighting consists of twenty-six points in screwed steel conduit, with Henley "Superite" cables. The nave and chancel are lighted by Harcourt directional lighting units, which for the illumination of the nave are fixed in the side aisles. This method was adopted owing to the length and height of the nave, which is flanked by columns and arches of the Early English period, with clerestory above. The beauty of the richly carved hammer-beamed roof is emphasised by the new lighting.

The British Broadcasting Corporation has placed orders

with Marconi's Wireless Telegraph Co., Ltd., and Standard Telephones and Cables, Ltd., for two additional short-wave broadcasting transmitters for the Empire Broadcasting Service. One transmitter will be supplied by each firm. The construction of a new building at Daventry to house the transmitters, together with a greatly extended aerial system, will begin shortly.

The Edison Swan Electric Co., Ltd., has recently supplied the "Tungar" rectifier equipment illustrated to the Whitehead Torpedo Co., Weymouth. It is of the industrial type rated at 36 A, 75 V, three-phase. There are six output circuits each having a maximum rating of 6 A at 75 V. Switching is arranged to enable two outputs, each of 18 A, or one output of 6 A to be obtained as desired. The output of each of the six circuits is controlled by a regulating resistance and transformer secondary taps and protected by suitable fuses. On the a.c. side each phase is controlled by a miniature circuit-breaker fitted with a thermal overload release. A watt-hour is incorporated to measure the input.



A "Tungar" rectifier equipment recently supplied to the Whitehead Torpedo Co.

The Great Southern Railway, I.F.S., has purchased a Philips public address equipment to be installed in two important stations for the purpose of speeding up the handling and improving the control of holiday crowds. The equipment comprises an amplifier giving an undistorted output of 20 W, four directional horn-type loudspeakers, and a "Type 4148" speech microphone.

New Manchester Showrooms

Referring to the note in our last issue describing its new premises at Manchester, the Sloan Electrical Co., Ltd., points out that the expression "tubular steel fittings" should have read "tubular lamps." These are an innovation which offers a combination of colours particularly suitable for the display of such articles as ladies' gowns.

Prices of Materials

Messrs. Henry Gardner & Co., Ltd., report, September 18th: Copper bars (best selected), sheet and rod £66 (£2 inc.) Pig lead, £17 10s. (15s. inc.) Block tin, £226 (£7 10s. inc.).

Messrs. Edward Till & Co. report, September 18th: No change in the price of India rubber, Para fine.

The Control of American Utilities

The Edison Electric Institute decided last week to take action to test the legality of the Public Utility Act under which the United States Government seeks to exercise a considerable amount of control over utilities in the hands of holding companies. Steps are also being taken to question the validity of the scheme for granting loans for the setting up of utilities by local authorities and of the Tennesee Valley Authority Act.

The German Electrical Market

Figures just published in *E.T.Z.* show that there was a decline in electrical machinery and cognate material imported into Germany during the first half of the current year from £1,045,365 to £879,675 (£=Rm.12.3) as compared with the corresponding six months of 1934. During the same period there was a slight increase in exports from £8,463,090 to £8,540,975.

The Shipping Exhibition

At the Shipping, Engineering and Machinery Exhibition now being held at Olympia, London, Messrs. Kryn & Lahy (1928), Ltd., have a representative display of K.L. steel castings, including components for electrical machinery. They are also showing Campbell cold starting horizontal oil engines, with totally enclosed gears, which run in oil-baths, and monobloc cylinders and liners, and "Coborn" petrol engines.

Two examples from their range of engines and compressors form the chief exhibits of the associated company, Messrs. J. Browett-Lindley (1931), Ltd. Both machines are arranged to run at low speed, and are provided with internal illumination so that the motion work and forced lubrication system can be seen in actual operation. Browett-Lindley compressors are built in all sizes up to a capacity of more than 5,000 cu. ft. per minute. The company's steam engines are made in the non-compound, compound or triple expansion types up to 1,000 b.h.p.

In addition to the equipment mentioned in our last issue Messrs. Ruston & Hornsby, Ltd., are showing one of their new oil-operated reverse-reduction gears, in conjunction with a 106-b.h.p. six-cylinder marine engine.

New Premises at Swinton

The Swinton and Pendlebury Urban Council has adopted a scheme presented by the electrical engineer for the provision of stores, a demonstration room, workshop and a sub-station on the Electric House site at an estimated cost of £3,000.

Canadian Development Proposals

In the course of a broadcast address last week Mr. Bennett, the Canadian Prime Minister, announced that it was his Government's intention, if returned to power, to investigate the question of the greater employment of the vast hydro-electric resources of Ontario, Quebec, and other provinces, and the general distribution of the energy produced. He also said that it was proposed to construct a chain of powerful broadcasting stations to serve the entire Dominion.

Change of Name

Telephone Rentals (Telematic), Ltd., Hollingworth Works, Martell Road, West Dulwich, S.E., has changed its name to New System Private Telephones, Ltd.

Trade Announcements

The branch of British National Electrics, Ltd., at 6, York Place, Leeds, has been extended and now includes an attractive showroom and further stores accommodation for its rapidly increasing business. A special display of new season's fires and "Universal" appliances is now being made.

The Hull branch of Callender's Cable & Construction Co., Ltd., has been moved to 11, Smeaton Street. The telephone number is unchanged.

Neon Luminous Tubes (Lundsigns), Ltd., have moved to 55, Bendon Valley, Earlsfield, London, S.W.18.

Klip Generating Station

In our issue of September 6th we mentioned that three electrically driven feed pumps are to be installed in the Klip generating station of the Electricity Supply Commission of South Africa. We are informed by the Harland Engineering Co., Ltd., that they are the makers of these three pumps and of the electric motors driving them.

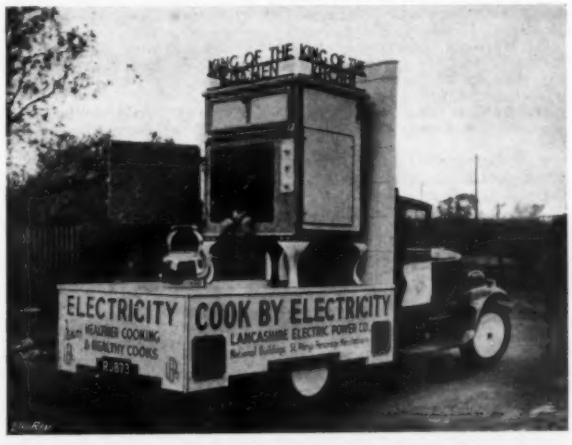
Increases of Capital

The nominal capital of Gwalia Radio Relay Service, Ltd., has been increased by the addition of £25,250 beyond the registered capital of £26,250. The additional capital is divided into 25,000 participating preferred ordinary shares of £1 and 5,000 deferred ordinary shares of 1s. each.

The nominal capital of Messrs. Knight and Hitchcox, Ltd., has been increased by the addition of £500 in £1 ordinary shares beyond the registered capital of £800.

L.E.P. Co.'s Farming Propaganda

Last Saturday special displays of electrical appliances were staged by the Lancashire Electric Power Co. at the Adlington Agricultural Show and at the Horticultural Society's annual show at Culcheth, near Warrington, thereby completing a summer programme of intensified propaganda work in farming areas. The week before a prominent stand was arranged at the Chorley Agricultural Show, and previously the company had arranged displays at the Brindle, Hoghton and District, Worsley and the Burnley Royal Lancashire Agricultural Shows. In addition, carnivals in surrounding rural areas and small townships have been entered by the company's decorated van illustrated in the accompanying photograph. This secured second prize at Westhoughton.



The L.E.P. Co.'s van at the Westhoughton Carnival

An Advertisement Corrected

Since the advertisement pages of this issue went to press our attention has been drawn to an error in the advertisement of the Britannia Electric Lamp Works (1934), Ltd., on Supplement p. 40. The British Standard Specification referred to on the carton should be of the year 1934 and not 1932 as stated.

New Catalogues and Lists

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.—A complete catalogue of "Ediswan" lamps has been issued. It also contains 60 pages of discount tables from ½ to 50 per cent.

Hackbridge Electric Construction Co., Ltd., Hersham, Walton-on-Thames.—A leaflet dealing with new on-load tap changing gear for small and medium-sized transformers.

Wandsworth Electrical Manufacturing Co., Ltd., Imperial Works, Kenyon Street, Birmingham, 18, has issued a complete illustrated catalogue of electrical installation accessories.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—A new catalogue of "Cosmos" lamps.

Holophane, Ltd., Elverton Street, Vincent Square, S.W.1.—Leaflets giving details of new lighting developments.

Ferguson, Pailin, Ltd., Higher Openshaw, Manchester, have issued new catalogue sections on the "GQ" air break switch and type "BV7" draw out metal-clad unit.

Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, Oxford Street, W.1.—A new catalogue of electric fires.

Midland Electric Mfg. Co., Ltd., Barford Street, Birmingham, has published a 96-page catalogue of M.E.M. switch-fuse and motor control gear. It includes a 20-page section of tables and information for the installation engineer.

British National Electrics, Ltd., Newarthill, Lanark.—New leaflets on cookers, irons and other domestic appliances.

Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester, 6, are publishing a large, well-illustrated catalogue of electrical and radio accessories, special attention having been paid to radio-interference suppression.

Winding-up Petition

J. Briggs Electrical Contractors, Ltd.—A winding-up petition presented by Messrs. Johnson & Phillips, Ltd., will be heard by the High Court on October 14th.

Bankruptcy Proceedings

Anne Marcus (Radio and Electric Stores), wireless dealer, "Glendower," 58, Beatty Avenue, Matthew Bank, and lately of 254, Shields Road, Newcastle-upon-Tyne.—This debtor filed her own petition and the first meeting of creditors was held recently at the Official Receiver's Office, 31, St. Mary's Place, Newcastle-upon-Tyne. The statement of affairs filed showed gross liabilities of £352, of which £323 was expected to rank for dividend, against net assets of £110. The case being a summary one was left in the hands of the Official Receiver as trustee.

E. J. Levermore, "The Cycle Shop," Queen's Road, Weybridge, Surrey, electrician.—The first meeting of creditors was held on September 11th at 29, Russell Square, London, W.C., when the statement of affairs showed gross liabilities of £389, of which £387 was expected to rank for dividend, with net assets of £121, leaving a deficiency of £266. The case being a summary one was left in the hands of the Official Receiver as trustee.

J. Cave and **T. W. Bowler** (Taylor and Wynne), electrical engineers, Back 180, Green Lanes, Small Heath, Birmingham.—First and final dividend of 1s. 7d. in the £, payable September 20th, at the Official Receiver's Office, Empire House, 159, Great Charles Street, Birmingham.

G. A. Goldsbrough (deceased), (G. A. Goldsbrough & Co.), electrical engineer, 24, Aldermanbury, Bradford.—Last day for receiving proofs for dividends, September 28th. Trustee, Mr. F. H. Langmaid, Official Receiver, Hallfield Chambers, 71, Manningham Lane, Bradford.

Lilian Haigh (S. Haigh & Co.), wireless and electrical dealer, 288, Keighley Road, Frizinghall, Bradford.—First and final dividend of 3s. 9d. in the £, payable September 19th at the Official Receiver's office, Hallfield Chambers, 71, Manningham Lane, Bradford.

H. D. Smith (Standard Radio & Electrical Co.), factor, 4a, Alpha Road, Surbiton.—First and final dividend of 5½d. in the £, payable September 25th at the trustee's offices, 135-8, High Holborn, London, W.C.1.

G. Harding, electrical engineer, The Grange, Barcombe, formerly partner in the firm of Harding & Botten, and lately carrying on business at 12, Emerald Street, London.—Discharge suspended until August 8th, 1938.

H. Barker (The Broadway Radio Stores), radio dealer, 848, Manchester Road, Bradford.—Discharged as from September 6th.

J. Robertson, electrical engineer, 63, Arran Road, Catford.—First dividend of 2s. in the £, payable September 20th, at the Official Receiver's Offices, 29, Russell Square, London, W.C.1.

Company Liquidations

Fox Industrial, Ltd., radio manufacturers, 29, Dingley Place, City Road, E.C.1.—The creditors of this company met in London on September 13th when a statement of affairs was submitted which showed liabilities of £2,603 and net assets of £130, leaving a deficiency, so far as the creditors were concerned, of £2,473. The issued capital of the company was £4,000, and as regarded the shareholders there was a deficiency of £6,473. Up to about a year ago the business was carried on successfully, but later the company entered into commitments which involved losses. Resolutions were passed confirming the voluntary liquidation of the company.

Edward Prior Electric Co., Ltd.—Winding-up voluntarily. Particulars of claims by September 28th to the liquidator, Mr. G. C. Stowell, 424, Salisbury House, London Wall, E.C.2.

Torquay Tramways Co., Ltd.—Meeting October 17th, at 88, Kingsway, London, W.C.2, to receive an account of the winding-up from the liquidators, Mr. H. T. Barnett and Mr. E. A. Bond.

Ferryside Electric Supply Co., Ltd.—Meeting October 16th, at 66, Queen Street, London, E.C.4, to receive an account of the winding-up from the liquidator, Mr. T. Penman.

Electricity Supply

Lighting, Domestic, Power

Boston.—RESULT OF INQUIRY.—As the result of a recent inquiry the Minister of Transport has consented to the Boston & District Electric Supply Co., Ltd., using overhead lines in the parishes of Freiston and Gedney.

Bristol.—REDUCED ELECTRICITY CHARGE.—As from October 1st the lighting flat rate is to be 4d. instead of 4½d. per kWh.

Burton-on-Trent.—SUB-STATION.—The Electricity Committee has acquired a site in Hartshorne Lane, Woodville, for the erection of a sub-station.

MAINS EXTENSIONS.—Mains are to be extended in the Beam Hill district at a cost of £2,000, and to the Midway area (£800).

Dorchester.—ENCOURAGING HIRE-PURCHASE.—The Electricity Committee has decided, now that the change-over is nearing completion, to undertake a publicity campaign to popularise its hire-purchase scheme.

Douglas (I.O.M.).—LOWER LIGHTING CHARGE.—The Electricity Committee has decided to reduce the lighting flat rate from 6½d. to 6d. per kWh.

Droxford.—OVERHEAD LINE.—The Rural District Council has consented to the West Hampshire Electricity Co., Ltd., erecting an 11,000-V transmission line at Swanmore Park.

Eastbourne.—LIGHTING THE NEW BANDSTAND AND PARADE.—In the design of the new bandstand and double-deck parade lighting is both a source of illumination and a decoration.

The new Eastbourne bandstand and parade

The shelters, promenade and bandstand have an illuminated frieze of amber, blue and cathedral-glass panels, lighted by concealed cornice strip consisting of 679 units, with tinned continuous bus-bar and terminal plugs in special cast boxes. Over 1,200 "Ediswan" lamps are employed for this purpose. For the illumination of the canopy to the middle parade shelter the Edison Swan Company's architectural lamps are used. The installation was carried out by Messrs. A. L. Davis (Eastbourne) in conjunction with Mr. Leslie Roseveare, the borough engineer.

Edinburgh.—NEW PORTOBELLO CHIMNEY.—A 350-ft. chimney is to be built at the Portobello power station. It will cost nearly £69,000.

France.—ELECTRICITY SUPPLY CONTRACTS.—There is likely to be a complete overhauling of the conditions under which the different electric light and power companies have obtained their concessions from the local or district authorities, according to the *Financial Times*. Local authorities who granted the concessions to the companies, or signed the relevant contracts, have been given until January 1st, 1936, to revise the conditions under which they signed such contracts. It is apparently considered by the Government that when the local authorities were induced to sign these contracts with the companies they did so without a complete knowledge of the conditions which were forced upon them by the companies. Finally, the Government has decided to bring into existence immediately a superior electrical council, which is to control and regulate the whole system of electricity supply in the country.

NEW TRANSMISSION LINE.—By a recent decree the Société de Transport d'Energie Rouergue-Auvergne has been authorised to construct a new 150-kV line from Viviez to Rueyres. The line is to tie in the 150-kV network which ends at Viviez with the Rueyres sub-station.

Glasgow.—RESPONSIBILITY FOR CORPORATION ELECTRICAL WORK.—A proposal that the Electricity Department shall undertake all the electrical work and installations required by other departments of the municipality is being considered. At present the department takes charge of electrical work for some of the other departments, notable exceptions being those dealing with transport, education, public assistance, and street lighting.

REWIRING THE ART GALLERIES.—The city engineer is to pre-

pare specifications for renewing the electrical installation at Kelvingrove Art Galleries, and a special sub-committee of the Park Committee is to visit the Tate Gallery, London, to inspect the lighting arrangements there.

NEW MAINS.—The Electricity Committee is to lay distributing mains at a cost of £8,498.

Guildford.—ANNUAL REPORT.—It is pointed out in the annual report on the electricity undertaking that a profit of £8,188 was made during the year ended March 31st last, although the supply to the Central Electricity Board decreased from 9,868,000 kWh to 229,700 kWh and there was an increase of £1,960 in the rates and an additional charge of £2,301 due to income-tax adjustment. The borough electrical engineer is Mr. W. Ellis Affleck.

Hamilton.—REDUCTION IN CHARGES.—The Electricity Committee has agreed to reduce the price of electricity to large consumers, the new charges being: 750/15,500 kWh per quarter, 2d. per kWh; 15,500/16,250 kWh, 1½d. per kWh; and 16,250 kWh and over, ¾d. per kWh.

India.—STONE CRUSHING BY ELECTRICITY.—The municipal commissioner has reported that one of the stone crushers has been converted from steam to electric drive. Whilst it is yet too early to arrive at a correct estimate of the saving effected, for the last two months the cost of crushing by electric power has been Rs.1.68 as compared with Rs.1.82 by steam. The electric motor which is at present driving one crusher is capable of driving two machines, so that a greater economy will result when the other is coupled up.

THE METTUR SCHEME.—In response to questions put to him recently in the Madras Legislative Council (states the *Commercial Gazette*, Calcutta) Sir K. V. Reddi stated that the coffer-dam round the site of the proposed Mettur power house had been completed and the area prepared for starting the foundations. Tenders for the power plant were under the consideration of Major Howard in London, and details of the plant decided on were expected shortly. Preparations had been made for starting work on the foundations in August, and materials were being collected. It was expected that the scheme would be completed about March, 1938. The Government would have the final voice in the acceptance of tenders and selection of machinery.

Letham (Angus).—STREET LIGHTING.—A scheme of street lighting was inaugurated on September 7th.

Norway.—POWER STATION EXTENSION.—The authorities of the municipal electricity supply undertaking of Oslo have recently decided to extend the steam-operated power station which is utilised for peak-load supply purposes and as a standby plant. The contract for the extension, which has been placed with the Brown Boveri Co., comprises two Velox boilers capable of supplying 75 tons of steam per hour at a pressure of approximately 400 lb. per sq. in., a 31,500-kW turbo-alternator, a 6,000/30,000-V transformer, and switchgear.

An unusual view of the clock tower of the House of Commons floodlighted with Siemens equipment last week on the occasion of the conference of the Association of Public Lighting Engineers

Peterhead.—ELECTRICITY IN MUNICIPAL HOUSES.—A sub-committee has been appointed by the Council with a view to inquiring into the question of installing electricity in Council houses.

Redcar.—SUPPLY TO ESTATE.—Intimation has been received by the Corporation that the Electricity Commissioners are prepared to grant a Fringe Order so that a supply may be given to a number of houses on the Coast Road estate. This will entail extension of the h.v. main and the provision of a sub-station.

Shotton (Co. Durham).—The Parish Council is to spend £2,500 on electric street lighting in the Horden Ward.

Straits Settlements.—SINGAPORE.—The report of the municipal electrical engineer, Mr. E. W. P. Fulcher, for the year ended December 31st, 1934, shows a decrease in the amount of electricity sold from 32,049,976 kWh to 31,635,369 kWh, due to a fall of two million kWh in energy sold for power purposes. The revenue increased from $2,191,689 to $2,323,178, the net profit at the end of the year being $602,046, although the load factor declined from 42.58 per cent. to 40.29 per cent.

Traction

Belgium.—RAILWAY ELECTRIFICATION.—The Joint Parliamentary Commission entrusted with the question of the electrification of the railways reports that as a result of the conversion of the Brussels-Antwerp line to electric traction, the passenger traffic shows an increase of about 20 per cent. for three weeks taken in June, July and August in the present year as compared with the corresponding weeks of 1934. Consideration is now being given by the Commission to the question of the electrification of the lines between Brussels and Arlon and between Liège and Marloie.

Bulgaria.—FUTURE ELECTRIFICATION.—The Bulgarian Government has sanctioned the schemes of the State Railways engineers for the electrification of the Sofia to Pernik and Sofia to Mesdra lines, and the work will begin as soon as financial arrangements can be made.

This view of a cable tunnel under the Thames appeared in the Exhibition of Photography in Commerce and Industry at the Royal Institute (Prince's) Galleries, Piccadilly, W. It is the work of Mr. G. Marshall Smith

France.—PARIS SUBURBAN WORKS.—The French State Railway is quadrupling the electrified tracks between Bois-Colombes and Argenteuil, and a 3,000-kW rotary convertor sub-station is being erected at Argenteuil to deal with the extra load. The total cost of the work will be about 5,000,000 fr.

Germany.—ELECTRIC LOCOMOTIVE ORDERS.—The German State Railways have on order twenty-seven main-line electric locomotives for delivery in the first half of next year.

Italy.—BATTERY-DRIVEN RAIL COACHES.—Rail motor coaches operated by accumulators have recently been put into service by the Compagnia Generale delle Tranvie Piemontesi, the Societa Tranvie Monsa-Trezzo-Bergamo and the Societa Tranvie Vicentine, of Vicenza, with a view to securing more economical running costs. The first of these concerns has now six coaches in operation. They are designed for a maximum speed of about 32 m.p.h., the motors having an hourly rating of 164 h.p. The second concern has three electric coaches with maximum speeds of 28 m.p.h., and the third one coach capable of travelling at 47 m.p.h. The coaches, the electrical equipment for which was supplied by the Societa Tecnomasio Italiano Brown-Boveri, of Milan, seat from 70 to 100 passengers. An interesting feature is the way the batteries are suspended under the floor in such a way separate cells can be interchanged without difficulty. Speed regulation is by series-parallel connection of the four motors, with the insertion of starting resistances. The batteries are of the lead grid plate type designed for a five-hour discharge. The mechanical part of the coaches accounts for about 52 per cent. of the dead weight, the electrical equipment for 15 per cent. and the battery for 33 per cent. Doctor P. Lo Balbo, manager of the Piemontesi Co., has reported that service charges have been reduced by 35 per cent. as compared with steam operation.

Japan.—ELECTRIFIED RAILWAY.—The I.G.R. is preparing to commence the work of electrifying the Suita-Kyoto section on the Kyoto-Osaka-Kobe line. The total cost is estimated at 5,600,000 yen, states our Yokohama correspondent.

Jugoslavia.—RAILWAY PROPOSALS.—Detailed estimates for the electrification of the Zagreb to Cakavac line are now being considered by the Jugoslav State Railway.

Newcastle-on-Tyne.—TROLLEY-BUS SERVICE.—The City Council's trolley-bus service between Denton Burn and Wallsend is expected to start on September 28th. All buses have been fitted with interference suppressors.

Newport.—ANNUAL REPORT.—A total revenue of £50,910, as compared with £50,447 for the previous year, is shown by Mr. A. Nichols Moore, the borough electrical engineer, in his annual report on the working of the transport undertaking for the year ended March 31st last. Working expenses also increased, from £45,777 to £45,964. The deficit on the tramways decreased from £10,512 to £6,419. There was a slight increase in the number of passengers carried to 7,624,253 (7,554,561 in the preceding year) and in the car-mileage from 892,108 to 894,677.

Russia.—RAILWAY ELECTRIFICATION.—The work of electrifying the second section of the Tiflis to Zestafoni railway was recently completed. The length of the electrified line is now about 115 miles, while before the end of the year another 38 miles will have been completed.

South Africa.—CONDITIONS AT JOHANNESBURG.—Despite strong protests by counsel for the Municipality that the evidence had nothing to do with the matters in dispute, detailed allegations that wasteful and lax conditions in the Johannesburg municipal workshops had not been remedied since the findings of the Spencer Commission were made before the Arbitration Court now dealing with the dispute between the City Council and the Johannesburg Tramway and Bus Employés' Union. The allegations were made by Mr. J. H. Forbes, who, subsequent to the Spencer Commission's report, was retired from the position of chief costing clerk. During his evidence, Mr. H. Teeger, chairman of the Tramway and Lighting Committee, declared that Mr. Forbes was simply trying to make points against the electricity manager, Mr. A. T. Rodwell, who was not present to defend himself.

Spain.—FAST ELECTRIC LOCOMOTIVES.—The Northern Railway of Spain authorities have recently placed an order for twelve new express electric locomotives required for lines which are to be electrified, namely those from Madrid to Villalba and Avila (75 miles) and Villalba to Segovia (40 miles). Each engine will be equipped with six 700 h.p. 1,350-V d.c. motors designed to give a maximum speed of 69 m.p.h.

Sweden.—RAILWAY ELECTRIFICATION.—Of Sweden's entire State railways a stretch of 3,231 kilometres, or 43.6 per cent., is now electrified or in the course of electrification, according to the Quarterly Review of the Skandinaviska Kreditaktiebolaget. The work has cost 265.7 million kronor (£13,984,000) and has been carried out during the last twenty-five years. During the course of the present month the 97-mile section of the northern main line from Krylbo to Bollnas is to be opened to electric traction, and it will be possible to run straight through from Malmö to Bollnas, a distance of 470 miles.

United States.—NEW YORK.—One of the largest orders for passenger equipment ever placed was recently announced by the Board of Estimate, New York City, when 500 cars were purchased for the city-owned subway lines, states *Mass Transportation*. The total cost amounts to $19,288,026.

Communications

Australia.—WIRELESS FOR SHIPS.—The Queensland Government has enacted regulations requiring all vessels of 200 tons or over, trading within the State, to be equipped with radio apparatus. In consequence nine vessels are now being fitted with the new automatic distress signal transmitter invented and manufactured by Amalgamated Wireless (A/sia), Ltd.—*Australian Electrical Engineer and Merchandiser.*

Brazil.—NEW WIRELESS STATION.—According to a *Reuter* message from Genoa, Senatore Marconi has left for Brazil to inaugurate a new high-power radio station at Rio de Janeiro.

Germany.—TELEVISION NEWS FOR BERLIN.—A news cinema, with television as part of its permanent equipment, is being planned to open in Berlin shortly. The Astor Theatre, Kurfürstendamm, has been chosen for the experiment, and technical experts are now working out the plans in conjunction with the German Film Chamber. The television apparatus will be mainly used for the rapid reproduction of news films which will be transmitted from a central television station. Apart from these transmissions there will be a regular service of news films, similar to those already shown in the news-reel theatres of London and Paris.—*Reuter.*

Great Britain.—A NEW CABLE.—A new telephone cable is shortly to be brought into use between London and Birmingham; it will enable two hundred conversations to be carried on simultaneously and will, it is hoped, considerably relieve the congestion during the night.

GALE DAMAGE.—The G.P.O. reported on Tuesday evening that 19,000 telephone lines had been put out of order by the gale.

Irish Free State.—WIRELESS LICENCES.—Our Dublin Correspondent reports that there are now 71,000 wireless licences in force in the I.F.S. This is an increase of 5,000 during the last five months.

Portugal.—BROADCASTING STATION BURNED DOWN.—A fire which broke out on Sunday destroyed the building of the Lisbon broadcasting station, although most of the technical equipment of the medium- and short-wave stations was saved.—*Reuter* (Lisbon).

Tasmania.—NEW TELEPHONE CABLE.—On Saturday, September 7th, the cable ship *Faraday* left the Woolwich works of Siemens Brothers & Co., Ltd., bound for Australia, where she will lay a cable between Apollo Bay on the Australian mainland and Stanley, in Tasmania. The distance between these two points is 162 nautical miles. Midway between them is the small King Island and, as the cable will be landed there, the *Faraday* is transporting the cable in two equal lengths of 81 nautical miles each. The cable is of a novel type, and contains one conductor only. Through this single wire it will be possible to transmit six telephone conversations, one radio broadcast programme, and a number of telegraphic communications simultaneously. This remarkable achievement has been made possible by carrier-current and voice-frequency equipment. At King Island and also at the Australian and Tasmanian ends repeaters and amplifier equipment will be installed. The cable is protected from mechanical injury by steel wire armouring in the usual manner. It has been manufactured entirely at the Woolwich works of the company, which will also carry out the laying operations.

The new Siemens cable for Tasmania being loaded into the C.S. "Faraday" at the company's Woolwich works

Broadcast Relay Service at Accra

A BROADCAST relay service has just been inaugurated at Accra, Gold Coast Colony, on somewhat similar lines to that which has been running for the past eighteen months at Freetown, Sierra Leone. Special short-wave battery-operated receivers were supplied as part of the equipment, and since it was desired to have a large initial capacity, the output stage consists of three "DA.100" amplifiers, each delivering an undistorted a.c. output of 90 W.

Altogether the equipment embraces seven racks built up on somewhat the same lines as panel switchboards in a central station. Apparatus for the control of batteries is mounted on one rack, and the receivers on two adjacent racks. A fourth rack accommodates a microphone amplifier and associated power panel, a panel with provision for terminating an incoming telephone, or other line, and, at the top, two panels carrying jacks which may be connected to lines for feeding sub-stations serving outlying districts. Other equipment on this rack consists of keys and faders through which are switched to the output amplifiers the leads from the receivers, microphone amplifier, gramophone pick-up and incoming line. A mains switch and fuse panel controls the a.c. supply to the whole equipment.

The three other racks accommodate two intermediate amplifiers and three "DA.100" amplifiers, mounting space being available on one of these racks for a fourth. By means of the cross-connection panels situated at the tops of these racks, either or both intermediate amplifiers may serve the desired number of power stages. An initial total of twelve feeder lines terminate on arrestor panels on the final rack, connected to the output amplifiers by plug-in jacks. There are twelve sets of jacks to each amplifier, and these are associated with the twelve arrestors, so that any amplifier can be connected to any feeder line. A pilot loudspeaker panel with independent volume control is also fitted, and this is arranged to test, as desired, the output of any of the power amplifiers.

A gramophone turntable cabinet was also supplied with the equipment. This is fitted on wheels and accommodates electrically driven twin turntables, with a volume control for each pick-up and a change-over switch to connect either pick-up to an output jack, from which connection is made by a double-ended cord to the gramophone jack on the main equipment.

For relaying local programmes over a land line to the main equipment for distribution to subscribers, a portable battery-operated microphone amplifier was supplied. Provision for the alternative use of two microphones is made, and a volume control enables the level at the sending end to be varied as desired. The whole of the equipment, as well as the loud speakers, was supplied by the General Electric Co., Ltd.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Abertillery.—September 26th. Urban District Council. Meters and cables. (September 13th.)

Aldershot.—September 30th. Corporation. Lighting installation. (September 13th.)

Argentina.—BUENOS AIRES.—October 15th. State Railways. Forty-eight splash-proof electric motors and twenty-six d.p. automatic switches. (T.Y. 10113.)*

Australia.—MELBOURNE.—Posts and Telegraphs Department. October 8th. Telephone switchboard parts and accessories. (T.Y. 10090.)* Telephone indicators of the drop, eyeball and ringing types (T.Y. 1008)* and various telephone dial parts. (T.Y. 10091.)*

October 15th. Testing instruments (voltmeters, ammeters, milliameters, &c. (T.Y. 10092.)*

October 15th. Voice frequency telephone repeaters and associated ringing equipment. (T.Y. 10089.)*

October 22nd Terminal and/or intermediate v.f. (1,000 cycles) ringers. (T.Y. 10093.)*

October 7th. City Council. 200 time switches. (T.Y. 10084.)*

MELBOURNE.—October 15th. Posts and Telegraph Department. 1,520 yd. lead and antimony covered submarine cable. (T.Y. 10114.)*

Birkenhead.—September 26th. Mersey Railway Co. Electrical fittings, lamps, sundries, &c. J. Shaw, general manager and secretary, Central Station.

Birmingham.—September 26th. Electric Supply Department. Cable protective covers. (September 6th.)

October 2nd. Electric Supply Department. E.h.p. cable. (See this issue.)

Burton-on-Trent—October 18th. Electricity Department. Electric heating apparatus. (September 13th.)

Canada.—TORONTO.—October 1st. Department of Works. One 500-h.p. 2,300-V three-phase synchronous motor. (T.Y. 10077.)*

Dover.—October 7th. Corporation. Transformer chambers. (September 13th.)

Egypt.—CAIRO.—October 7th. Department of Public Health. X-ray apparatus. (T.Y. 10063.)*

GIZA.—October 8th. Ministry of Education. Radio-telephone transmitting set, television equipment and radio components. (T.Y. 10064.)*

October 19th. Mechanical and Electrical Department, Ministry of Public Works. Supply and erection of electrically driven pumping set for Arish Barracks. (T.Y. 5290.)*

Erith.—September 19th. Electricity Department. Transformer, switchgear, and laying, jointing and testing h.p. and l.p. cables. (September 6th.)

Glasgow.—September 19th. Corporation. Electrical installation, Blackhill housing estate. Town clerk.

Public Assistance Committee. Heating panels at Crookston Home, and wireless equipment at Lennox Castle institution.

Gloucester.—Electricity Department. Meters and paper-insulated cable. (See this issue.)

Gloucestershire.—County Council. Electric light installation at Hanham Abbots junior school. R. S. Phillips, F.R.I.B.A., Shire Hall, Gloucester (deposit £2 2s.).

Great Western Railway.—September 26th. Telegraph instruments, electrical apparatus, &c. (September 13th.)

India.—SIMLA.—October 22nd. Stores Department. D.c. and a.c. electricity meters as required during the period January 1st, 1936, to December 31st, 1936. (T.Y. 10083.)*

NEW DELHI.—December 5th. Stores Department. A.c. ceiling fans. (T.Y. 10111.)* December 12th. D.c. ceiling fans. (T.Y. 10109.)* January 9th. A.c. and d.c. table fans. (T.Y. 10110.)*

October 15th. India Store Department. 66-kV overhead transmission lines for Malakand hydro-electric scheme. (September 13th.)

Iran.—Ministry of Posts and Telegraphs, Teheran. 6,000 m. insulated cables. (September 13th.)

Irish Free State.—DUBLIN.—September 20th. Electricity Supply Board. Meters. (September 6th.)

October 25th. Electricity Supply Board. 25,000-kVA, 5/38-kV transformer. (See this issue.)

Leyton.—October 7th. Electricity Department. Cable. (See this issue.)

Midlothian and Peebles.—District Asylum, Rosslynlee. September 28th. Electrical fittings. L. Addison-Smith, 19, Heriot Row, Edinburgh.

Morecambe and Heysham.—October 2nd. Public Lighting Department. Steel poles, centre suspension units, lanterns, &c. (See this issue.)

Newport (ISLE OF WIGHT).—September 23rd. Corporation. Electrically driven centrifugal sewage pumps. Sandford Fawcett & Partners, 53, Victoria Street, S.W.1 (deposit £3 3s.—cheques to be made payable to the Newport Corporation).

Newcastle-upon-Tyne.—City Council. Electrification of the lift at the Laing Art Gallery. City architect, Town Hall.

New Zealand.—CHRISTCHURCH.—October 15th. Municipal Electricity Department. Twelve 200-kVA single-phase, oil-immersed indoor type transformers. (T.Y. 10095.)*

INVERCARGILL.—November 4th. City Council. Supply of 660 V and 11,000 V paper-insulated lead-covered, steel tape armoured cables. (T.Y. 10100.)*

November 4th. Tramways and Electricity Department. One single-panel h.v. cubicle and one 6-unit l.v. ironclad switchboard. (T.Y. 10012.)*

WELLINGTON.—October 17th. Post and Telegraph Department. Battery plates. (T.Y. 10066.)*

October 29th. Secondary cells and accessories. (T.Y. 10068.)*

October 30th. Telephone relay and condenser strips. (T.Y 10069.)*

November 12th. Secondary cells. (T.Y. 10070.)* Telephone transformers, dials, plungers and telephones. (T.Y. 10101.)*

January 14th, 1936. Public Works Department. Three 1,667-kVA oil-immersed, self-cooled outdoor single-phase transformers. (T.Y. 10105)* and slate panels with steel framework, o.c.b. control switches, operation indicators, &c., in connection with the installation of indoor switchgear at the Henderson sub-station.

Northern Ireland.—BELFAST.—September 23rd. Town Council. Electrically driven centrifugal pump with switchgear, piping, valves, &c., for the Greencastle pumping station. City surveyor's department (Engineering Section), Room 94, City Hall (deposit £1 1s.).

Oldham.—September 23rd. Electricity Committee. L.v. cable. (September 13th.)

Oswestry.—September 30th. Electricity Department. E.h.p. transmission line and cable. (See this issue.)

Pontardawe.—September 30th. Electricity Department. 200-kVA transformer and kiosk. (See this issue.)

Ross and Cromarty.—County Council. Electric lighting and heating at new academy, Dingwall. D. Matheson & Sons, architects, Dingwall (deposit £2 2s.).

St. Andrews.—September 30th. Town Council. Electrical work at Muttoes Lane housing estate. Walker and Pride, Church Square, St. Andrews (deposit £1 1s.).

Salford.—October 2nd. City Council. Power transformers. (See this issue.)

Sleaford.—September 24th. Electricity Department. E.h.v. and l.v. mains, sub-station, kiosk, e.h.v. and l.v. switchgear. (September 6th.)

South Africa.—CAPE TOWN.—October 2nd. Electricity Supply Commission. H.v. cable and underground cable joint boxes. (T.Y. 10061.)* Three oil-immersed 300-kVA three-phase transformers. (T.Y. 10060.)* Totally enclosed switchgear comprising three complete switchboards. (T.Y. 10057.)*

PRIESKA.—October 9th. Municipality. Electrical generating plant, switchgear, distribution and consumers' equipment. (T.Y. 10067.)*

Trimdon (Co. DURHAM).—Extension of the electric street-lighting system at Trimdon Colliery. J. G. Fenney, clerk, Roper's Terrace, Trimdon Grange.

Uruguay.—MONTEVIDEO.—October 18th. State Electricity Supply and Telephone Administration. Fifty-eight oil-immersed static transformers. (T.Y. 10059.)*

November 4th. State Electricity Supply and Telephones Administration. 300,000 metres of paper and compound insulated cotton served and braided Hackethal type wire and cable. (T.Y. 10103.)*

Walsall & West Bromwich.—September 16th. Barr Colony Joint Board. Supply of engineers' and electrical fittings for six months from October 1st. Clerk and steward of the Institution, Great Barr Park Colony.

West Lancashire.—October 7th. R.D.C (A) Two sets of electrically operated automatic sewage pumping plants. (B) Two sets of electrically operated automatic screening plants. (C) Circular sprinkling filters, valves, penstocks, &c., required for the Sefton area drainage scheme. H. B. Ward, consulting engineer, 26, North John Street, Liverpool (deposit £5 5s. in each case).

Willesden.—October 9th. Middlesex County Council. Electric lighting, power, ward and staff signalling installations in two ward blocks, Central Middlesex County Hospital. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Bradford.—Electricity Committee. Accepted. Feed-water heaters for boiler-feed pumps at Valley Road power station.—Holden & Brooke, Ltd., Manchester.

Forfar.—Library Committee. Accepted. Lighting installation at library.—Bremner Brothers, Forfar.

Glasgow.—Police Committee. Accepted. Electrical work and heating of police signal boxes (£167).—Haddow & Co., Ltd.

Lighting Committee. Accepted. Electrical fittings.—British Electrical & Manufacturing Co., Ltd.

Corporation. Recommended. Lift installation in Kelvingrove Art Galleries (£492).—Glasgow Engineers, Ltd.

Transport Committee. Accepted. Ticket-issuing machine mechanism.—Hall's Telephone Accessories (1928), Ltd. (makers).

Electricity Committee. Accepted. Sub-station (£173), Nelson Street.—Bruce & Sons.

Kirkcaldy.—Town Council. Accepted. Electrical installation at Abden Home.—Moncrieff Bros., Ltd., Shorehead, Leven.

Manchester.—Housing Committee. Accepted: Electrical installations at four housing schemes (650 houses).—H. C. Taylor & Co., Manchester. Installations in 106 houses, Newton Heath.—R. H. Clampett & Co., Ltd., Manchester.

Newcastle-upon-Tyne.—City Council. Accepted. X-ray equipment (power unit and shockproof cable) at the General Hospital (£436).—Schall & Son, Ltd. Similar equipment for the infectious hospital (£688).—Schall & Son, Ltd. X-ray equipment (motor-driven couch, diagnostic shockproof tube, &c.) for the General Hospital (£1,127).—Victor X-ray Cpn., Ltd.

Renfrewshire.—County Council. Accepted. Electrical work for eighty-six houses.—Reid & Carrick (Renfrew).

Notes

Change-overs and Cinema Installations

At the beginning of 1934 the Western Electric Co., Ltd., devised a scheme whereby it offered to co-operate with cinema exhibitors and electricity supply undertakings to cover the change-overs from d.c. and odd frequency a.c. to the standard 50-cycle a.c. supply in so far as the alterations affected the sound equipment and its associated conversion apparatus. As a result the company was requested to carry out the work in more than 95 per cent. of cinemas which have changed over during the last four years. This scheme is now being reissued to cover the introduction of new types of sound systems; charges for changing-over the sound system and its associated conversion apparatus are reduced, and the supply undertakings are being notified of the amended scheme.

E.A.W. Summer School

A successful summer school for domestic science teachers has just been concluded at the Gloucestershire Training College of Domestic Science. Apart from the schools organised by the Association for the Board of Education, this was the first of its kind and it was undoubtedly of great value, especially to those teachers whose domestic science centres have only recently been equipped with electrical apparatus. In many cases special leave of absence to attend was given and in all 107 students were accepted out of nearly twice as many applications.

Cable Reconditioning

A four-line cable-reconditioning plant recently put into operation by the Detroit Edison Co. is described in *Electric Light & Power*. It is used for the treatment of cable that has been removed from one duct system for reinstallation, if still serviceable, in another. Each line consists of a set of idle rollers on which is mounted a loaded reel of cable, two sets of rotators to turn the cable on its longitudinal axis so that lead burning can be done round the entire circumference, an inspection and duct-splicing bench equipped with mirrors, and a set of variable-speed motor-driven rollers. Before inspection and the subsequent patching of bad sections by burning in new lead, the sheath is cleaned by a portable sand-blast machine. Wastage of short lengths of cable has been reduced by the development of duct joints for 24,000-V and 4,800-V three-conductor cables. The connections for the 24,000-V conductors are made by phosphor-bronze sleeves, $\frac{3}{32}$ in. thick and $2\frac{1}{4}$ in. long, the soldered joint having a conductivity of 98 per cent. and a tensile strength of 104 per cent. of the conductor. A long leakage path to earth is provided by stepped insulation of paper tape, except at the connecting sleeve where oil-immersed varnished cambric tape is used. The 350,000 CM joint is 56 in. long and the maximum diameter, finished, is $\frac{1}{4}$ in. greater than that of the cable. The lead covering is made by wrapping a $\frac{1}{8}$-in. lead sheet round the cable flush with the sheath and lead-burning the longitudinal and two circumferential joints. It is now economical to splice sections as short as 35 ft.

Cooling Towers Burned at Liverpool

Four cooling towers at the Lister Drive power station, Liverpool, were destroyed by fire last Sunday. They had been disused for about a year and the supply of electricity was not interrupted.

Iron and Steel Institute

The autumn meeting of the Iron and Steel Institute was opened at Manchester on Monday and terminated yesterday. Of the thirteen papers presented dealing with various aspects of metallurgy, none was directly electrical in its scope, though some have, or no doubt will have, an indirect bearing on the problems of our own industry. Thus, the improved ability of steel to withstand high temperatures has made an outstanding contribution to the economical production of electricity, and the study by Dr. C. H. M. Jenkins and Mr. G. A. Mellor of "The Structural Changes in Mild Steel and Commercial Irons during Creep," which represents the result of investigations carried out in the National Physical Laboratory, may be regarded as having a bearing on power station design. The object of the authors is to correlate the structure and constitution of alloys with their behaviour under prolonged application of stress at temperatures of from 300 to 900 deg. C.

Appointments Vacant

Sub-station superintendent for Poplar Borough Council.

Probationary inspector in the Post Office Engineering Department.

Part-time demonstrator for the electrical machinery laboratory of the Regent Street Polytechnic.

Junior charge engineer for Newport (Mon.).

Showroom superintendent for Paisley.

Two junior engineers for Crewe Electricity Department.

(See our classified advertisements.)

Makers' Names Wanted

Domestic electrical incinerators.

Strand Corner House Extensions

Notable lighting installation

APPROXIMATELY five hundred new lighting points and a hundred new power points have been installed in the extended and partly rebuilt Lyons' Corner House in the Strand, London. In the new brasserie, which has been constructed in the mediæval style on the lower ground floor, perhaps the most striking feature is the design of the wooden lighting fittings, which have been specially made to match the surroundings. They are of both the pendant and wall-bracket type, and are finished in red, green, and yellow. The shades are of the "curved truncated cone" type.

Along one side of the room "evening" light, provided entirely by electric lamps outside, shines through windows of imitation "crown" glass such as was used in old London buildings. The space behind these lighted windows, apart from acting as a plaster reflector for the lighting itself, serves as a duct for the smoke extracts in connection with the air-conditioning and ventilating system. The apparatus for this was designed and installed by the Carrier Engineering Co., Ltd., and supplies over forty tons of conditioned air per hour. The cooling and dehumidification are automatically controlled.

Novel lighting fittings are used in the new brasserie at Messrs. J. Lyons's Strand Corner House

Synchronised electric clocks have been installed throughout the building, and concealed amplifiers relay band music on all three floors. Eight new lifts have been introduced.

In the new public telephone room flashing amber lamps over each kiosk indicate to the customer that the operator has obtained the number required. The signal ceases as soon as the receiver is lifted. An electrically operated blind can be drawn horizontally across the balcony well when only the ground floor is open for all-night service.

Electricity is obtained from the Charing Cross Supply Co. at 11,000 V, being transformed to 230 V single-phase for lighting and 400 V three-phase for power. The switch-room, completely re-equipped with modern iron-clad three-phase main distribution boards, is controlled by cubicle type oil circuit breakers. The whole of the reconstruction work was carried out under the superintendence of the Building, Engineering and Electrical Departments of Messrs. J. Lyons & Co., Ltd.

The following were among those supplying electrical equipment:—Metropolitan-Vickers Electrical Co., Ltd.; Simplex Electric Co., Ltd.; Walsall Conduits, Ltd.; G. P. Dennis & Co., Ltd.; Wandsworth Electrical Manufacturing Co., Ltd.; Hackbridge Cable Co., Ltd.; Derby Cables, Ltd.; General Electric Co., Ltd.; Blunt & Wray, Ltd.; F. H. Pride; Alexander Black; Reliance Telephone Co., Ltd.; Kelvin, Bottomley & Baird, Ltd.; Tubelight Sales, Ltd.; Crompton Parkinson, Ltd.; Synchronome Co., Ltd.; Troughton & Young, Ltd.; Wm. McGeoch & Co., Ltd.; Julius Sax & Co., Ltd.; British Electric Lamps, Ltd.; Marryat & Scott, Ltd.; Waygood-Otis, Ltd.; and James Keith & Blackman Co., Ltd.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Miss Elsie Stanbury, who was married on September 7th to Mr. Harold Rowden, was presented with a Ferranti fire and an electric coffee percolator by the staff of the Dix's Field offices and the Sidwell Street showrooms of the Exeter Corporation Electricity Department, where she had been employed, and a Smith's electric clock from the Exeter branch of the Electrical Association for Women, of which she was assistant honorary secretary.

Mr. Harry T. Cort, 73, Newman Street, W.1, late sales manager of the Brush Electrical Engineering Co., Ltd., has been appointed representative by Messrs. Barton & Sons (1935), Ltd. (incorporating Neon Manufacturers, Ltd.).

Mr. H. Pickering, of the staff of the Barnsley Corporation Electricity Department, was married at Scarborough on September 11th to Miss Kathleen Raine.

Dr. Cosslett, B.Sc., Ph.D., of Bristol University, and **Mr. M. Stienon,** B.A. (Oxon), B.Sc.(Eng.), London, have been appointed to the teaching staff of Faraday House Electrical Engineering College.

The *Electrical Engineer and Merchandiser* publishes the names of the members of the Electrical Advisory Committee which has just been set up by the New South Wales Government to consider and report on matters of generation, transmission and supply of electricity generally. They include Messrs. H. E. Street (chairman), under secretary, Department of Local Government; V. J. F. Brain, chief electrical engineer, Department of Public Works; W. H. Myers, chief electrical engineer, Department of Railways; and J. R. Firth.

Mr. N. W. Kenwright, of the Croydon Corporation electricity works staff, was married at Farnworth on September 7th to Miss Phyllis Wilcock, of Farnworth.

[*Lafayette*

Professor Miles Walker

Professor Miles Walker, D.Sc., F.R.S., Professor Emeritus at Manchester University, was married on September 11th to Miss Valerie Ellis at Glenfield Parish Church. Professor Miles Walker is well known in the electrical engineering world. From 1912 to 1932 he was professor of electrical engineering at Manchester University. He was formerly designer of a.c. machinery to the British Westinghouse Co. He has been responsible for a number of improvements in electrical machinery, and is the author of many technical books and papers. After a honeymoon in Devonshire Professor and Mrs. Walker will reside at Dunkirk House, Amberley, Gloucestershire.

Mr. G. Coughtrie, secretary of the Belmos Switchgear Co., Bellshill, was married to Miss Jessie M'Donald, Motherwell, on September 11th. On the previous day he was presented with two clocks and a silver candlestick by the staff and employés of his company.

Mr. W. T. Conder, general manager of the Australian Broadcasting Commission for the past two years, has resigned.

Mr. J. R. Soans, who is the only son of Mr. and Mrs. R. C. Soans, of Broughton, near Kettering, was recently married to Miss Nina M. Hardwick, of Northampton. After studying

Mr. and Mrs. J. R. Soans

engineering at Nottingham and Oxford, the bridegroom joined his father in the firm of Messrs. Barnett & Soans, Ltd., the well known Midland electrical engineers.

Mr. W. N. Edge, who is on the staff of the Wessex Electricity Co., was married at Marlow on September 14th to Miss B. E. Hale, of Highbridge, Somerset.

Mr. Edwin W. Connon, B.Eng. (L'pool), B.Sc. (Eng.), Research Department, English Electric Co., Stafford, was married on September 14th to Miss M. Senior, eldest daughter of Mr. F. R. Senior, of the company's Publicity Department.

Mr. E. J. Emery, now general manager of E.M.I. Service, Ltd., has been appointed managing director of the company. This organisation is responsible for the maintenance and service of all products of Electric & Musical Industries, Ltd.

Mr. A. C. Hazel, sales superintendent of the South Somerset and District Electricity Co., Ltd., was married at St. Gabriel's Church, Plymouth, on September 14th, to Miss M. E. M. Prideaux, of Plymouth. His address will be "Tregullan," Yawle, Lyme Regis.

Obituary

M. R. Hecker.—The death recently occurred in Paris at the age of fifty-two of M. Robert Hecker, vice-president of the Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston, and a director of several other French electrical undertakings.

Mr. T. P. Pask.—A cable from South Africa announces the sudden death on August 29th of Mr. Thomas Percival Pask, M.I.E.E., of Cambridge.

Mr. M. Paddon.—The sudden death is announced of Mr. Manesseh Paddon, who had for many years been in business as an electrical engineer at Chulmleigh, Devon. He was 61 years of age.

Mr. F. Thirkettle.—The death occurred on September 10th at the age of 42 years, of Mr. Frank Thirkettle, station supervisor at the works of the Sheerness & District Electric Supply Co., Ltd.

A New Carrier-current Coupler

FOR use on the Boulder Dam transmission system of the City of Los Angeles Bureau of Power and Light, operating at 287 kV, the American General Electric Co. is supplying carrier-current couplers having characteristics described as considerably superior to any previously considered. The high-frequency carrier-current will be used for relaying, supervisory control of switching station, telephone communication between stations, and telephone communication with patrolmen's cars in the vicinity of the line.

According to *Electrical Engineering* the capacitor coupler for 287 kV is made up of four units, each rated at 69 kV. The same type, therefore, can be used for 69, 138 and 230 kV circuits by using one, two or three units in series. The capacitors are intended to serve the double purpose of carrier-current coupling and potential coupling. For 287,000 V a capacitance of 0.00075 mfd. sufficed, so that with four units in series the unit capacitance is 0.003 mfd., which is also adequate to supply 150 volt-amperes for potential devices.

The condensers in each unit are contained in a one-piece cylindrical and deeply petticoated porcelain shell. Alternate layers of paper and aluminium foil are wound on a cylindrical mandrel to form a roll which is subsequently flattened to an approximately square shape. The paper extends beyond the foil sufficiently to provide adequate creepage distance. The rolls are assembled into stacks and connected in series. Each set of rolls is divided into four groups by "herkolite" separators, the ends of the stack being connected to the cap and base respectively. The interior of the unit is filled with mineral oil, completely covering the capacitor element. The cap forms an expansion chamber to contain the inert gas which serves as a cushion to prevent excessive pressure in the oil at high temperatures.

The base casting of the bottom unit is made larger than the others and contains a 15-kV porcelain bushing mounted at the upper end. From a terminal block on the bottom of this bushing a lead is taken to the potential device in a housing below the base. The block also supports one electrode of a protective gap, and the receiving clip for an earthing switch which is hinged on a bracket mounted at the bushing clamp. This earthing switch is actuated by a push rod mounted in the hinged door of the base and operated externally. In one side of the base is a corrugated porcelain outlet through which the insulated lead to the carrier-current cabinet is passed. Generous creepage surface from lead to earth is given to this outlet so as to minimise loss of carrier-current energy through leakage.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Armature & Electrical Repairs, Ltd.—Private company. Registered September 9th. Capital, £4,000 in £1 shares. Objects: To acquire the business of an armature and engineering company carried on by Thos. C. Long and A. G. Long at St. Stephens Road, Newport, Mon. The directors are: T. C. Long (permanent managing director), "Lynvale," Glassllwch Crescent, Newport, Mon., and A. G. Long, 5, Graig Park Circle, Malpas, Newport, Mon.

Crypton Equipment, Ltd.—Private company. Registered September 9th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of, agents for and dealers in battery charging equipment, electrical test benches and electrical cylinder boring machines and specialised electrical equipment required for use in garages, &c. The first directors are: J. G. Shaw, "Thirlmere," 2, Hillside Road, Bushey, Herts., and three others.

Coupe & Jones, Ltd.—Private company. Registered September 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers, contractors, suppliers of electricity, &c. The directors are: R. S. Jones, 97, Plains Road, and W. Coupe, "Sefton," Fernleigh Avenue, both of Mapperley. Registered office: 2, Westdale Lane, Mapperley, Notts.

A. W. Marsh, Ltd.—Private company. Registered September 11th. Capital, £1,000 in £1 shares (250 6 per cent. cumulative preference and 750 ordinary). Objects: To carry on the business of manufacturers, suppliers and repairers of and dealers in lamps, reflectors, bells, fires, stoves, cookers, &c. The subscribers are: A. W. Marsh, electrical engineer, and Mrs. A. A. Marsh, both of 4, Stanley Road, Finchley, N.2. Solicitor: E. Gordon Sykes, 4, Stanley Road, East Finchley, N.2.

G. R. Cresswell & Co., Ltd.—Private company. Registered September 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers of and dealers in all kinds of radio receivers and transmitters, &c.; to enter into hire-purchase agreements with purchasers of such articles, &c. The directors are: G. Cresswell (permanent director and chairman), electrical engineer, 140, Manchester Road, Accrington; and J. E. Holmes, electrical engineer, 9, Edleston Street, Accrington. Registered office: 7a, Blackburn Road, Accrington, Lancs.

Radiomenders, Ltd.—Private company. Registered September 12th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in radio, television and electrical apparatus, &c. The first directors are: E. A. Tickle (chairman and managing director) and two others. Secretary: K. W. Tickle. Registered office: 123-125, Parchmore Road, Thornton Heath, Surrey.

L. B. Mundin, Ltd.—Private company. Registered August 30th. Capital, £500 in £1 shares. Objects: To carry on the business of dealers in and manufacturers of radio or wireless telegraphy sets and apparatus of all kinds and television sets, appliances and parts, to enter into hire-purchase agreements, &c. The permanent directors are: L. B. Mundin, Springfield, Park Avenue N., Northampton, and Mrs. E. Mundin, Springfield, Park Avenue North, Northampton. Solicitors: Rays & Vials, Northampton.

Thirsk Relay Service, Ltd.—Private company. Registered September 10th. Capital, £500 in £1 shares. Objects: To acquire the business of a radio relay service carried on by C. R. Pinchbeck at Thirsk, Yorks, as the Thirsk Relay Service. The permanent directors are: Charles R. Pinchbeck, 20, Fishergate, Ripon, Leonard C. Robinson, 553, Hessle Road, Hull, radio engineers. Registered office: Paragon House, The Green, Thirsk.

Gorst Electrical Co., Ltd.—Private company. Registered September 13th. Capital, £12,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in scientific instruments, radio and television sets, apparatus and accessories, electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, &c. The permanent directors are: R. B. Whittingham, "Oakdene," Manor Road, Esher, Surrey, wireless manufacturer, and two others. Secretary: Arthur Lee. Registered office: Portadyne Works, Gorst Road, North Acton.

Auto-Illuminated Signs, Ltd.—Private company. Registered September 13th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with A. C. Alexandra and to carry on the business of engineers and founders, metal workers, manufacturers of electric signs, &c. N. Gilbert, 28, Essex Street, Strand, W.C.2, signs document as director. Registered office: 28, Essex Street, Strand, W.C.2.

Pearl & Pearl, Ltd.—Private company. Registered September 13th. Capital, £5,000 in £1 shares. Objects: To acquire the business of a dealer in electric incandescent lamps and electrical accessories and goods connected with radio telephony and telegraphy carried on by J. E. Pearl as "Pearl & Pearl," at 190, Bishopsgate, E.C., and elsewhere. J. E. Pearl is permanent director. Registered office: 190, Bishopsgate, E.C.2.

Pamgay's, Ltd.—Private company. Registered September 9th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in weighing and measuring instruments, violet-ray and X-ray tubes and apparatus, neon and all other forms of electrical signs and illuminations, &c. The subscribers are: H. Pearl, 68, Hendon Way, N.W.2, and G. E. Webb, 39, Montserrat Road, Putney, S.W. Secretary (pro tem.): G. E. Webb. Registered office: 20a, Market Place, St. Albans, Herts.

Returns of Electrical Companies

Electric Cushions, Ltd.—Debenture dated September 3rd to secure £100 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Cox Cavendish Electrical Co. (1924), Ltd., 105, Great Portland Street, W.1.

Ruberoid Co., Ltd.—Satisfaction in full on August 23th of mortgage dated April 27th, 1927, and registered April 29th, 1927. (According to the register of mortgages, the mortgage registered April 29th, 1927, originally secured all moneys due to bank.)

Peto Scott Co., Ltd.—Satisfaction to the extent of £2,400 (balance) on December 31st, 1934, of debentures authorised July 28th, 1930, and registered July 31st, 1930, securing £4,000. (Notice filed September 6th, 1935.)

H. G. Weaver, Ltd.—H. K. Campbell, 9, Denmark Street, Bristol, ceased to act as receiver and manager on August 31st.

Electrofile, Ltd.—C. H. Bennett, High Holborn House, W.C.1, ceased to act as receiver and manager on July 9th.

Wilson Manufacturing Co., Ltd.—Particulars filed on September 4th of debentures not exceeding £1,000, authorised July 10th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

British Gapehart Corporation, Ltd.—Debenture dated August 30th to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Siemens-Schuckert (Great Britain), Ltd.—Mortgage on properties on the Chase Estate, Park Royal, Acton, and at Isleworth, dated August 26th, 1935, to secure £6,027, and further advances not exceeding therewith £17,609 8s. Holders: Allnatt Holding Co., Ltd., 109, Kingsway, W.C.

Pertrix, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1934 (filed May 15th, 1935). All shares taken up. £10,000 paid. Mortgages and charges, nil.

Polperro Electric & Cold Storage Co., Ltd.—Capital, £10,000 in £1 shares. Return dated January 17th (filed July 8th), 1935. 9,373 shares taken up. £8,373 paid, £1,000 considered as paid. Mortgages and charges, nil.

British Insulated Cables (S.A.), Ltd.—Capital, £2,000 in £1 shares. Return dated March 8th, 1935. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Mather & Platt, Ltd.—Capital, £2,500,000 in £400,000 preference stock, £1,363,660 ordinary stock, and £736,340 unclassified. Return dated March 8th, 1935. £400,000 preference and £1,363,660 ordinary stock taken up. £630,660 paid on £292,000 preference stock and £338,660 ordinary stock, £1,133,000 considered as paid on £108,000 preference stock and £1,025,000 ordinary stock. Mortgages and charges, nil.

Windsor Electrical Installation Co., Ltd.—Capital, £150,000 in 50,000 5 per cent. preference, 25,000 7 per cent. preference, 50,000 ordinary, and 25,000 unclassified shares, all of £1. Return dated March 12th, 1935. 23,532 5 per cent. preference, 25,000 7 per cent. preference, and 50,000 ordinary shares taken up. £73,532 paid on the 5 per cent. preference and ordinary shares, £25,000 considered as paid on the 7 per cent. preference shares. Mortgages and charges, nil. A further 15,000 shares were allotted as "ordinary," payable in cash and fully called up on April 16th, 1935.

Alton District Electricity Co., Ltd.—Capital, £25,000 in £1 shares. Return dated March 28th, 1935. All shares taken up. £25,000 paid. Mortgages and charges, nil.

Salisbury Electric Light & Supply Co., Ltd.—Capital, £125,000 in £1 shares. Return dated March 26th, 1935. All shares taken up. £122,500 paid, £2,500 considered as paid. Mortgages and charges: £15,700.

Hendon Electric Supply Co., Ltd.—Capital, £600,000 in 200,000 preference and 400,000 ordinary shares of £1 each. Return dated March 25th, 1935. All shares taken up. £347,113 paid on 200,000 preference and 147,113 ordinary shares, £252,887 considered as paid on 252,887 ordinary shares. Mortgages and charges: £172,140.

Yorkshire Traction Co., Ltd.—The nominal capital has been increased by the addition of £50,000, in £1 ordinary shares, beyond the registered capital of £250,000.

Distinctive Signs, Ltd.—Debenture dated August 20th, 1935, to secure not more than £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. H. Butcher, 16, Oxford Terrace, London, W.2.

Langs (Wimbledon), Ltd.—Capital, £4,000 in £1 shares. Return dated March 13th, 1935. All shares taken up. £4,000 paid. Mortgages and charges, £500.

P. M. de Groot, Ltd.—Particulars filed of debentures not exceeding £400, authorised July 18th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £400.

Boynton & Co., Ltd.—Particulars filed on August 31st of debentures not exceeding £4,000, authorised August 21st, 1933, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £4,000. The date of the first execution of any of the debentures was August 27th, 1935.

Mackereth's (Coventry), Ltd.—Particulars filed of debentures not exceeding £400, authorised August 30th, 1935, charged on

the company's property, present and future, including uncalled capital, the amount of the present issue being £400.

Frederick Waterhouse, Ltd.—The nominal capital has been increased by the addition of £1,000 beyond the registered capital of £1,000. The additional capital is divided into 1,000 5 per cent. cumulative preference shares of £1 each.

Engineering Products, Ltd.—Debenture, dated August 17th, 1935, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Rosa Boardman, Oaktree House, Prospect Road, Birmingham.

Challis Transformers, Ltd.—Debenture, dated August 21st, 1935, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital (subject to prior charge dated March 10th, 1934). Holder: Thomas E. Morton, 35, Russell Terrace, Leamington Spa.

Power, Light & Heat, Ltd.—Mortgage on freehold lands, hereditaments and premises at Commonside, Crowle, Lincs, dated August 27th, 1935, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Telephone and Associated Services, Ltd.—Capital, £15,000 in £1 shares. Return dated March 25th, 1935. All shares taken up. £3,000 paid. £12,000 considered as paid. Mortgages and charges, nil.

Electrical Manufacturers Finance Co., Ltd.—Capital, £10,000 in £1 shares. Return dated March 25th, 1935. All shares taken up. £10,000 paid. Mortgages and charges, nil.

Kidderminster & District Electric Supply Co., Ltd.—Capital, £100,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated March 25th, 1935. All shares taken up. £100,000 paid. Mortgages and charges, nil.

Westminster Electric Supply Corporation, Ltd.—Capital, £2,000,000 in £550,000 preference and £1,450,000 ordinary stock. Return dated March 12th, 1935. All stock taken up. £1,305,620 paid on the preference and £755,620 ordinary stock, £694,380 considered as paid on £694,380 ordinary stock. Mortgages and charges, nil.

North Metropolitan Power Station Co., Ltd.—Capital, £100 in £1 shares. Return dated March 26th, 1935. All shares taken up. £100 paid. Mortgages and charges: £1,589,375.

H. J. Cash & Co., Ltd.—Capital, £25,000 in £1 shares. Return dated March 12th, 1935. 15,650 shares taken up. £10,650 paid, £5,000 considered as paid. Mortgages and charges, nil.

Gorseinon Electric Light Co., Ltd.—Capital, £60,000 in £1 shares. Return dated March 6th, 1935. All shares taken up. £60,000 paid. Mortgages and charges, nil.

Northampton Electric Light & Power Co., Ltd.—Capital, £1,000,000 in 75,000 preference and 925,000 ordinary shares of £1. Return dated March 13th, 1935. 52,500 preference and 725,000 ordinary shares taken up. £777,500 paid. Mortgages and charges: £500,000.

Matthews Electric Signs, Ltd.—Capital, £2,000 in £1 shares. Return dated March 23rd (filed May 11th), 1935. 1,512 shares taken up. £909 10s. paid (£1 per share on 2 shares and 15s. per share on 1,210 shares), £300 considered as paid on 300 shares. Mortgages and charges, nil.

Lancashire United Transport & Power Co., Ltd.—Capital, £500,000 in 300,000 5½ per cent. cumulative preference and 200,000 ordinary shares of £1 each. Return dated March 14th, 1935. 300,000 preference and 192,878 ordinary shares taken up. £101,306 paid, £391,572 considered as paid. Mortgages and charges: £6,500.

Colestion, Ltd.—Debenture dated September 4th to secure £2,500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Moorgate Nominees, Ltd., 4, Moorgate, E.C.

Streamline Radio, Ltd.—Particulars filed of debentures not exceeding £6,000, including £5,000 already registered, authorised August 19th, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Truphonic Radio (Putney), Ltd.—Capital, £1,000 in £1 shares. Return dated February 26th, 1935. All shares taken up. £1,000 paid. Mortgages and charges, nil.

City Notes

Ferranti, Ltd.—The directors report a net profit of £54,304 for the year ended June 30th last, after providing for general establishment charges, bad debts, repairs and renewals, taxation, discount and interest, directors' fees, depreciation, investment reserve and losses of subsidiary companies. This compares with £68,245 for 1933-34. The allocation to investment reserve (£7,388) is a new item. A balance of £51,659 brought forward is added, making £105,963. The general reserve receives £2,929 (against £10,000), the preference dividend absorbs £35,000, and the ordinary dividend is maintained at 6 per cent., requiring £18,000. A balance of £50,034 is carried forward. The report states that further extensions to buildings and plant were made during the year and a freehold works at Moston, Manchester, was purchased and equipped with the most modern machinery for the production of radio receivers. The meeting is being held to-day (Friday) in London.

Companies to be Struck Off the Register.—The names of the following companies will be struck off the Register at the expiration of three months from September 13th unless cause is shown to the contrary:—The Beeches Radio & Electrical Co., Ltd.; Electriclocks & Radio, Ltd.; Goldvick Electrical & Radio Co., Ltd.; Sentry Dry Battery Co., Ltd.; Viozone, Ltd.; Waddon Radio, Ltd.; and Waldron Electrical Manufacturers, Ltd.

The Utilities Power & Light Corporation reports a total revenue of $3,365,942 for the year ended March 31st last. Expenses absorb $399,083 and after making provision for debenture interest ($2,570,000), loan interest and sinking fund ($278,553), abandoned developments ($60,000), taxes ($30,440) and depreciation ($21,914), there was a net income of $5,950.

The Scottish Power Co., Ltd.—The directors are to offer as rights to ordinary shareholders on the register at September 7th one ordinary share for every six ordinary shares held at 32s. per shares. This will involve the issue of 538,333 new shares.

An interim dividend of 2½ per cent. (same) has been declared on the ordinary capital.

The Hankow Light & Power Co., Ltd., reports a profit of £10,250 for the year ended March 31st last. To this is added £20,006 brought in, and after placing £5,000 to reserve and providing for preference dividends and for cumulative dividends of 8 per cent. on the ordinary shares for each of the years ended March 31st, 1934 and 1935, a sum of £17,457 is carried forward. Meeting to-day (Friday).

The British Columbia Power Corporation and its subsidiaries report total net profits of $2,334,000 for the twelve months ended June 30th, an increase of $689,000 as compared with 1933-34. After providing for dividends on the preference and class "A" shares amounting to $649,000 and $1,500,000 respectively, there is a surplus of $185,000.—*Reuter.*

J. & F. Stone Lighting & Radio, Ltd., report a profit of £25,156 for the year ended June 30th last, as compared with £8,004 for the preceding six months. After transferring £3,750 to income-tax reserve and writing £4,777 off preliminary expenses, &c., it is proposed to pay a final dividend of 5 per cent., making 10 per cent. for the year, leaving £1,265 to be carried forward.

The British Power & Light Corporation, Ltd., is to pay an interim dividend on its ordinary shares for the first time on October 1st, when 2 per cent. will be distributed. For the preceding nine months up to December 31st, 1934, 3¾ per cent. was paid, as compared with 3 per cent. for each of the previous three years.

Philips' Incandescent Lamp Works Holding Co., of Eindhoven, Holland, has deferred consideration of the payment of an interim dividend "until the results of the Geneva discussions are known."

Ward & Goldstone, Ltd.—The usual interim dividend for the half-year on the cumulative preference shares at the rate of 7 per cent. per annum, will be paid on September 30th.

The International Automatic Telephone Co., Ltd., is to pay an interim dividend of 3 per cent. less tax (same) on its ordinary shares.

The Young Accumulator Co. (1929), Ltd., has placed nearly 60,000 2s. shares privately in order to provide capital for expanding business.

Chadburn's (Ship) Telegraph Co., Ltd.—At a meeting held in Liverpool recently the shareholders approved a scheme for the reconstruction of the capital of the company.

The Canadian General Electric Co. has again declared a dividend of 75 cents per share on its common stock.

British Insulated Cables, Ltd., announces an interim dividend of 5 per cent. less tax (same) on its ordinary capital.

The Hendon Electric Supply Co., Ltd., is maintaining its interim ordinary dividend at 2½ per cent. free of tax.

The Midland Counties Electric Supply Co., Ltd., proposes to maintain its interim dividend on the ordinary shares at 2½ per cent.

The Sun Electrical Co., Ltd., is to pay dividend of 6 per cent. (against 5 per cent.) on its ordinary shares.

Stocks and Shares

TUESDAY EVENING.

WITH the political kaleidoscope changing from day to day, sometimes from hour to hour, it is not surprising to find Stock Exchange business and prices alternating as rapidly as the colours in a child's toy. At the end of last week, the outlook was deemed to be much brighter and there was a general improvement in nearly all the active markets of the Stock Exchange. The week-end produced a fresh declaration of intransigeance from Mussolini, with the result that markets fell once more upon dullness. Then, on Tuesday, came another burst of hopefulness.

This time, Stock Exchange prices are moving more or less as a whole. In the ordinary way, when some markets are dull others are cheerful, but just now the one overshadowing uncertainty of war affects everything round the House. That there is plenty of money awaiting investment is obvious enough to those engaged in financial business. It is equally clear that many of the people who ordinarily would be buying stocks and shares, are still reluctant to enter markets lest continued unsettlement may bring about a further decline in prices. This state of affairs makes its influence felt more particularly in the purely investment markets. The recent animation in American utility and railroad descriptions gives signs of subsiding, though the Wall Street Stock Exchange has its spasms of optimism and prices are well maintained.

The Gilt-edged Market

Central Electricity stocks show some sympathy with the weaker tendency that has lately characterised the Consol market, owing to the impression that a substantial loan may be raised in the near future by the Government for the purpose of expanding the Navy, Army and Air Force. Dismissed first as no more than idle gossip, this impression is now making its force felt more generally. People are on the look out for some pronouncement that will indicate the Government's intention with regard to bringing the services up to greater strength. The 5 per cent. 1950-1970 issue of the Central Electricity Board is a point down at 115. One or two of the Board's other stocks are also easier. London Passenger Transport

issues hold their ground. The "C" stock at 102 is again a point to the good.

Home Electricity Supply

Last week's recovery which occurred in this section has not been maintained. County of London are 1s. 6d. easier at 55s., City of London 6d. at 38s., North Metropolitans have fallen ⅛ to 57s. 6d. Of the provincial shares Lancashire Electrics dropped to 36s. The Scottish group is also easier. The Scottish Power Company is about to offer one new ordinary share, at 32s., for every six ordinary shares held. Although the price of the old shares has gone back 1s. 9d. to 40s. 9d., the bonus involved is a pleasant one. Clyde Valley are 1s. down at 41s. British Power & Light, after being 32s., receded to 30s. 6d. The interim dividend, of 2 per cent. actual is hardly up to expectations. In the overseas shares, Palestine "A," which were 51s. last week, gave way to 48s. on a fair line of shares coming into the market. These being absorbed, the price rallied a trifle to 49s. (Lord Reading, who has been ill this week, is chairman of the company.) Other alterations in the group are of no great consequence. The fall in prices brought in a certain amount of investment buying. Hendon Electrics at 55s. are unaffected by the declaration of the usual 2½ per cent. tax free interim dividend. The Scottish Power Company's interim of 2½ per cent. is payable less tax on October 1st.

Cable and Wireless

In the scurry to get out of stocks earlier in the week, Cable and Wireless "A" ordinary fell to 22, a drop of a couple of points. From this, recovery occurred to 23, on the rumour that Mussolini had given an indication of being willing to negotiate, even at this eleventh hour, and that a chance was accordingly presented for preserving peace between Italy and Abyssinia. This report brought about the general change-over in sentiment that restored, on Tuesday, a number of falls which took place on Monday. Cable preference is 2 down at 97½.

Markets are in a highly sensitive condition, and, as noticed before in similar circumstances, the purchase or sale of comparatively small amounts of stock is sufficient to bring about a fairly sharp rise or fall respectively. Globe Telegraph & Trust ordinary are ¼ better. In the transatlantic group, American Telephone and Telegraph shares are quoted ex the quarterly dividend of 2½ per cent. Allowing for this, the shares retain their last week's rise of 8 points. Anglo-American Telegraph preferred is 10s. lower at 116.

Manufacturing and Equipment

The disposition in this market is towards rather lower prices in correspondence with the tendency of other sections round the Stock Exchange. The decline started last week, in shares such as Henley's, Enfield Cable, Callender's and a few others. By reason of the general disposition already mentioned, prices weakened still further on the first business day this week. There was something of a rally, however, and the falls were partially restored. Associated Equipment have been dull at 41s. Ericssons fell to 7½d. British Aluminium ordinary gave back 1s. 6d. of the rise of 1s. 9d. recorded last week. The same tendency is observable in the Iron and Steel group. Babcock & Wilcox are a trifle lower at 50s. 9d. The cheerful showing made by the Board of Trade Returns became lost, as a Stock Exchange factor, in the gloom spread by the Mussolini speech of Saturday last. Though this depression was subsequently dissipated to some degree, prices did not entirely recover the losses which they had previously sustained.

Miscellaneous Matters

British Electric Traction deferred is 30 points lower at 1075. The support of Victoria Falls "split" shares is very consistent, the price quickly picking up to 3½ after it had dipped to 3¼ sellers. Brazilian Tractions are a lively spot for the time being; Montreal has been accumulating the shares. The American-Canadian utilities show no particular movement, but the Wall Street speculators continued to take a favourable view of the outlook.

The Preference Shareholder

Investors will observe with much interest the movement now in progress towards lower prices for high-priced preference shares. Some people who place conservation of capital first, and who consider that income is of secondary importance, are starting to realise preference shares whose current prices present a target to the slings of possible depreciation. Such decline in value would be a logical accompaniment to a fall in gilt-edged stocks. Were the selling of preference shares to become at all general it will be admitted that to-day's prices must inevitably suffer, because of the scope they offer for depreciation. But there are two major reasons for assuming the retention of these shares by most of their holders. The first is the difficulty of knowing what to do with the money if such shares are sold. And the second is the fact that in the majority of cases the shares were acquired at lower prices than obtain to-day and, at those prices, afford the holder a reasonable return on his capital. So that the holder, unless he is tempted to sell preference and to buy ordinary shares with the money, philosophically decides to retain his present interest rather than go to the trouble and expense that a change of investments would involve.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Sept. 17.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3½	—	3 17 5
City of London	1	7½	7½	38/–	–6d.	3 19 0
Clyde Valley	1	7	8	41/–	–1/–	3 18 0
County of London	1	10½	10½	54/6	–1/6	3 17 0
Edmundson's 7% Pref.	1	7	7	36/–	—	3 16 9
Do. Ord.	1	7	8	41/6	–6d.	3 17 1
Elec. Dis. Yorkshire	1	9	9	47/–	–1/–	3 16 9
Elec. Fin. and Securities	1	12½	12½	3½	—	3 11 5
Elec. Supply Corporation	1	11	11	3½	–⅛	3 10 3
Lancs Light and Power	1	7½	7½	36/–	–1/–	4 3 4
Lond. Assoc. Electric	1	—	—	32/6	–1/6	4 6 2
London Electric	1	7	8	38/6	—	4 3 0
London Power deb. Red.	Stock	5	5	109½	—	4 11 4
Metropolitan	1	10	10	52/6	–6d.	3 16 6
Midland Counties	1	7	7	36/6	–6d.	3 16 8
Mid. Elec. Power	1	8	8	42/6	—	3 15 3
North Eastern Electric Ordinary	1	6	6	32/6	–6d.	3 13 9
Do. 7% Pref.	1	7	7	35/6	—	3 18 9
Northampton	1	10	10	51/3	–⅛	3 18 2
Notting Hill 6% Pref.	10	6	6	14½	—	4 1 4
North Met. Elec. Ordinary	1	10	10	57/6	–⅛	3 9 5
Do. do. 6% Pref.	1	6	6	32/–	—	3 15 0
Scottish Power	1	8	8	40/9	–1/9	3 18 6
South London	1	7	7	35/6	—	3 18 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/–	—	6 0 0
Yorkshire Elec.	1	8	8	44/–	—	3 12 9
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	115	–1	4 7 0
Do. 1955–75	,,	5	5	118	–½	4 4 8
Do. 1951–73	,,	4½	4½	110	—	4 1 10
Do. 1963–93	,,	—	3½	104	—	3 7 0
London Elec. Trans. Gtd.	,,	—	2½	96	–1	2 12 1
London & Home Counties, 1955–75	,,	4½	4½	114	—	3 19 0
London Passenger Transport, A.	,,	—	4½	123½	—	3 12 10
Do. do. B.	,,	—	5	127½	—	3 18 9
Do. do. C.	,,	3	—	102	+1	2 18 9
West Midlands Joint Elec. 1948–68	,,	—	5	115	—	4 7 0
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	142½xd	—	6 6 4
Anglo-Am. Tel. Pref.	Stock	6	6	116	–½	5 3 0
Do. Def.	,,	1½	1½	27½	—	5 9 1
Cable & Wireless 5½% Pref.	,,	2¾	4½	97½	–2	4 4 7
Do. A. 7½% Ord.	,,	Nil	Nil	23	–1	—
Do. B. Ord.	,,	Nil	Nil	7½	–½	—
Globe Tel. & Tel. Ord.	10	2½	3½*	12¾	+¼	2 14 5
Do. do. Pref.	10	6	6	13¾	—	4 7 3
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	32/6	—	4 12 4
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 15 1
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1075	–30	—
Do. do. Pref. Ord.	,,	8	8	177½	—	4 10 2
Brazil Traction	100	—	—	8	+½	—
Brit. Columbia Elec. Rly. Pfd.	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	20	3½	—	—
West Riding	1	5	6½	42/–	—	3 2 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	3	—	5 0 0
Assoc. Elec. Ord.	1	4	6	35/–	—	3 8 7
Do. Pref.	1	8	8	37/6	—	4 5 4
Babcock & Wilcox	1	6	8	50/9	–6d.	3 3 0
British Aluminium Ord.	1	5	7½	42/6	–1/6	3 10 7
British Insulated Ord.	1	5	15	4⅞	–⅛	3 7 8
Brush Ord.	Stock	Nil	Nil	49½	—	—
Callender's	1	15	15	3½	—	4 2 10
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	—	12½	3⅞	+⅛	0 19 0
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	24/3	—	2 17 9
Enfield Cable Ord.	1	25	25	4¾	–⅛	5 1 3
English Electric	1	Nil	Nil	17/6	—	—
Do. do. Pref.	1	Nil	Nil	21/3	–⅛	—
Ericssons Tel.	1	—	24	7½	–¾	3 7 7
Ever Ready	5/–	35	35	22/–	—	7 19 0
Ferranti Pref.	1	7	7	28/–	—	5 0 0
G.E.C. Pref.	1	6½	6½	32/6	–⅛	4 0 0
Do. Ord.	1	8	10	3½	—	3 5 8
Henley's	1	30	30	6¾	—	4 8 0
Do. 4½% Pref.	5	4½	4½	5½	—	3 16 8
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	41/3	—	3 12 9
Siemens Ord.	1	6½	4	22/6	—	3 11 0
Telegraph Construction	£1	Nil	Nil	23/9	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

31738. "Electric converting apparatus." British Thomson-Houston Co., Ltd. November 16th, 1932. (433697.)

31858. "Electric valve current control systems for a.c. circuits." British Thomson-Houston Co., Ltd. November 17th, 1932. (433698.)

32317. "Method of transmitting telegrams through the medium of one or more exchanges." E. E. Kleinschmidt. January 5th, 1933. (433862.)

36114. "Means for indicating the adjustment of the tuning arrangements of wireless receivers and like apparatus." M. C. Booth. December 22nd, 1933. (433940.)

1934

1847. "Electric welding apparatus." Westinghouse Electric & Manufacturing Co. January 25th, 1933. (434018.)

2399. "Optical systems for television and the like." Scophony, Ltd., and J. H. Jeffree. January 23rd, 1934. (433945.)

4939. "Wireless and like receivers." Plessey Co., Ltd., and C. E. G. Bailey. February 14th, 1934. (433707.)

5006. "Electric battery lamps." Ward & Goldstone, Ltd., and S. Goldstone. February 15th, 1934. (433709.)

5056. "Automatic regulating means for use with rectifying and inverting electric arc convertor power plant." General Electric Co., Ltd., and H. H. Taylour. February 15th, 1934. (433782.)

5103. "Cables adapted to transmit high-frequency electric currents." E. C. Cork and E. L. C. White. February 15th, 1934. (433711.)

5138. "Means for cleaning electric insulators." Croydon Cable Works, Ltd., J. H. C. Brooking, and H. R. Allen. February 16th, 1934. (Cognate applications 14850/34 and 31109/34.) (433712.)

5197. "Beacons for aircraft and the like." General Electric Co., Ltd., L. W. Barsdorf, and W. A. Villiers. February 16th, 1934. (433715.)

5233. "Thermionic valve de-modulating arrangements for amplitude modulated carrier-wave oscillations." Marconi's Wireless Telegraph Co., Ltd. (Telefunken Ges. für Drahtlose Telegraphie). February 16th, 1934. (433863.)

5313. "Means for repairing the screens of electric cables." Pirelli-General Cable Works, Ltd., and P. Pillon. February 17th, 1934. (433864.)

5456. "Printing telegraph receiver." R. E. M. Penot. February 17th, 1933. (434021.)

5468. "Electric signalling system." G. C. H. Clayton and E. L. Thompson. February 19th, 1934. (433788.)

5491. "Electric-discharge devices." British Thomson-Houston Co., Ltd., H. R. Ruff, W. J. Scott, and L. J. Davies. February 19th, 1934. (433789.)

5529. "Sparking plugs." J. H. Booth. February 20th, 1934. (433717.)

5562. "Manufacture of electrodes for welding purposes." J. G. Jackson. February 20th, 1934. (433718.)

5595. "Television or like apparatus." J. L. Baird and Baird Television, Ltd. February 20th, 1934. (433720.)

5666. "Electric resistance and method of producing same." Radioakt-Ges., D. S. Loewe. February 22nd, 1933. (433790.)

5724. "Traffic beacons, street lamps and the like." J. R. W. Gunning. February 21st, 1934. (Cognate application 17647/34.) (433794.)

5768. "Alternating-current impulse relays." Telefonaktiebolaget L. M. Ericsson. February 24th, 1933. (433797.)

5829. "Electromagnetically operated valve." A. Mousley and R. Crittall & Co., Ltd. February 22nd, 1934. (433729.)

5833. "Electric lighting equipment for trolley buses." C.A.V.-Bosch, Ltd., W. H. Glaser, N. R. Wood, and J. W. Pletts. February 22nd, 1934. (433870.)

5844. "Aeroplane landing systems employing electromagnetic waves." C. Lorenz Akt.-Ges. May 10th, 1933. (433873.)

5901. "Electromagnetically operated step-by-step switches." Automatic Electric Co., Ltd., and R. N. Saxby. February 22nd, 1934. (433877.)

5990. "Automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. February 24th, 1933. (433956.)

5996. "Control systems for electrically propelled vehicles." General Electric Co., Ltd., and E. H. Croft. February 23rd, 1934. (433881.)

6070. "Magnetic chucks." C. A. Gardner and A. C. Gardner. February 24th, 1934. (433733.)

6201. "Electric-discharge devices." British Thomson-Houston Co., Ltd., and J. A. V. Fairbrother. February 26th, 1934. (434028.)

6339. "Electric gas-blast switches." British Thomson-Houston Co., Ltd. February 28th, 1933. (433883.)

7317. "Compounding of electrical metal vapour rectifiers by grid-control apparatus." English Electric Co., Ltd., W. R. Evans and J. A. St. C. Richardson. March 7th, 1934. (433967.)

7490. "Current transformers." G. Stein. March 9th, 1934. (Cognate application 820/35.) (434030.)

8615. "Induction apparatus." L. Siegl Auto-Licht-Zund-Service-Ges. August 19th, 1933. (433970.)

9427. "Electric protective systems." General Electric Co., Ltd., and C. C. Garrard. March 26th, 1934. (433887.)

9772. "Electric fires." A. Bell & Co., Ltd., and N. M. Bell. March 29th, 1934. (433736.)

10524. "Electrical-discharge devices for production of luminous effects." P. Freedman. April 6th, 1934. (433804.)

10665. "Electric fuse isolators." Switchgear & Equipment, Ltd., and A. G. H. Oxley. April 9th, 1934. (434032.)

10941. "Electric switches of the multi-way or selector type." E. W. Hobbs. April 11th, 1934. (433972.)

11675. "Draw-out types of electric switchgear." English Electric Co., Ltd., and A. A. Heath. April 18th, 1934. (Cognate application 14252/34.) (433891.)

13410. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 24th, 1933. (Addition to 425103 and 425601.) (433811.)

13425. "Telephone advertising methods and apparatus therefor." I. L. Lesavoy and S. Z. Koenigsberg. May 3rd, 1934. (434036.)

15978. "Wireless receiving apparatus." V. Von Trentini. May 29th, 1934. (433817.)

16244. "Electrolytic devices." J. B. Brennan. May 31st, 1933. (Cognate application 16245/34.) (433818.)

16477. "Electric power transformers." Electrical Improvements, Ltd., and R. R. Pattinson. June 2nd, 1934. (433904.)

16558. "Electrically operated lifts." General Electric Co., Ltd., and A. A. Chubb. June 4th, 1934. (433905.)

16559. "Tuned electromagnetic relays or interrupters." General Electric Co., Ltd., and W. R. Rose. June 4th, 1934. (433906.)

18982. "Mercury switches." W. W. Triggs (Adlake Co.). June 27th, 1934. (433740.)

19051. "Electron-discharge devices." Telefunken Ges. für Drahtlose Telegraphie. June 27th, 1933. (433822.)

30382. "Electric gas-blast switches." British Thomson-Houston Co., Ltd. October 23rd, 1933. (433914.)

33026. "Circuit controlling devices, particularly applicable to electric refrigerators." Igranic Electric Co., Ltd. January 29th, 1934. (434064.)

33634. "Thermionic valve amplifiers." Marconi's Wireless Co., Ltd. November 22nd, 1933. (433837.)

34261. "Electrical invertors or frequency-changers." E. Ostwald. November 28th, 1933. (Cognate application 34262/34.) (434068.)

35286. "Cathode-ray tube apparatus." Telefunken Ges. für Drahtlose Telegraphie. December 7th, 1933. (433996.)

36238. "Apparatus for electric resistance welding." L. Breguet. December 18th, 1934. (434071.)

36980. "Radio signalling systems." Marconi's Wireless Telegraph Co., Ltd. December 23rd, 1933. (433842.)

1935

336. "Radio receiving systems." Standard Telephones & Cables, Ltd. May 5th, 1934. (433843.)

647. "Electric clocks." A. G. Jarry. January 8th, 1935. (433746.)

1025. "Electric indicating and measuring apparatus." British Thomson-Houston Co., Ltd. January 12th, 1934. (433747.)

1152. "Furnaces to be used for electrolysis by the fusion process and for electrometallurgy." L. Ferrand. February 24th, 1934. (434001.)

2424. "Switch boxes for controlling electrically driven appliances." J. T. Shevlin (Siemens-Schuckertwerke Akt.-Ges. January 24th, 1935. (434075.)

3182. "Three-phase transformers comprising three wound cores and safety devices." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 12th, 1934. (434076.)

3563. "Electron-tube generators." C. Lorenz Akt.-Ges. February 5th, 1934. (433924.)

3966. "Electric-circuit arrangements for electric-discharge devices." General Electric Co., Ltd. February 7th, 1934. (434077.)

5185. "Sparking plug." H. Willig. February 18th, 1935. (434009.)

5208. "Plug sockets for electrical connections." G. E. Marr. February 18th, 1935. (434078.)

6761. "Electric vacuum cleaner." Baumgarten-Ges. October 11th, 1934. (433850.)

9433. "Gas-blast electric switches." British Thomson-Houston Co., Ltd. March 26th, 1934. (433933.)

9569. "Junction boxes for high-tension electric cables." Naamlooze Vennootschap Nederlandsche Kabelfabriek. March 28th, 1934. (433952.)

11294. "Contacts for electric switches." Plessey Co., Ltd. (Mallory & Co., Inc., P. R.). April 11th, 1935. (434084.)

11322. "Electrolytic electricity meters." Jenaer Glaswerk Schott & Gen. April 17th, 1934. (434012.)

12280. "Electric measurements." I. Miyamoto. April 23rd, 1935. (433768.)

12342. "Installations comprising an electric-discharge tube." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 30th, 1934. (433769.)

12541. "Electric water heaters." L. P. Haussauer. April 26th, 1935. (434013.)

13114. "Voltaic couples." Plessey Co., Ltd. (Mallory & Co., Inc., P.R.). May 2nd, 1935. (433771.)

14159. "Variable inductances suitable for the tuned high-frequency circuits of wireless receiving apparatus." W. J. Polydoroff and Aladdin Industries, Ltd. August 25th, 1934. (Divided out of 24357/33.) (433772.)

14618. "Mercury switches." W. W. Triggs (Adlake Co.). June 27th, 1934. (Divided out of 433740.) (433773.)

15202. "Television and like system." J. L. Baird and Baird Television, Ltd. November 21st, 1933. (Divided out of 32460/33.) (433853.)

15547. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 8th, 1934. (433854.)

18344. "Film television and like systems." J. L. Baird and Baird Television, Ltd. January 22nd, 1934. (Divided out of 2171/34.) (433935.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 11th:—

Atlantis. No. 562130. Class 8. Radio apparatus, amplifiers, and public address equipment.—John E. Dallas & Sons, Ltd., 6-10, Betterton Street, Drury Lane, W.C.2.

Elgee. No. 551614. Also LG (lettering and design). No. 551795. Class 8. Electric motors, relays, current transformers, potential transformers, switches for remote control, and electric time switches.—Landis & Gyr, Ltd., Victoria Road, North Acton, W.3.

Novex. No. 562235. Class 50. Synthetic resins sold in the form of sheets, rods, tubes and shaped pieces, and as moulding powders.—I.C.I. (Fertilisers and Synthetic Products), Ltd., Imperial Chemical House, Millbank, Westminster, S.W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ayr.—Additions to Heathfield hospital (£4,450) and clinic (£1,614); burgh surveyor. Cinema, New Road (£9,100); Newton-on-Ayr Picture House Co., Ltd., 142, St. Vincent Street, Glasgow.

Barnet.—Hospital extensions (£37,700), for the Isolation Hospital Committee; clerk.

Bebington (CHESHIRE).—Church, Storeton; Duncan Campbell, architect, Crosby.

Beckenham (KENT).—Church, West Wickham (electrical work); Hammond & Miles, Ltd., builders, Ilford.

Birkenhead.—Tenements (£44,960), for the Corporation; Lloyd & Cross, Ltd., builders.

Birmingham.—Coroner's court, Newton Street (electrical work); Peacock & Bewlay, architects, 83, Colmore Row.

Blidworth (NOTTS).—Cinema, Mansfield Road, for Rainworth Theatres, Ltd., Rainworth; secretary.

Blyth.—Public baths, Broadway; borough engineer. Flats, Wright Street; Pattison & Hush, builders, Union Street. Houses, Cypress Gardens; J. E. Dover, builder, Croft Road. Flats, Broadway Crescent; J. Goulding & Sons, builders, Simpson Street.

Bristol.—Two public baths, Knowle and Speedwell; city engineer.

Bromley (KENT).—Cinema, café, &c. (electrical work); E. F. Tulley, architect.

Buckhaven.—Houses (20), at Factory Road; burgh surveyor.

Burstow (SURREY).—Shopping centre, Rookery Hill estate; Sutton Smith, architect.

Canterbury.—Houses (132), Vauxhall estate; H. W. Collingwood, Barham.

Cardiff.—Houses (104), Sloper Road; town clerk.

Carlisle.—New town hall and houses (24), Wigton Road; city engineer, 18, Fisher Street. Houses (96), Newtown estate, for the City Council; J. and R. Bell, builders, Nelson Street. Houses (147), Etterbea estate; Border Engineering Contractors, Ltd. Houses (118), Currock estate; John Laing & Son, Ltd. Church, Shady Grove Road; Seeley & Paget. New swimming pool; city engineer.

Cheshire.—Drill hall and public hall, Connah's Quay; secretary, Cheshire Territorial Army Association, The Castle, Chester. School, Town Lane, Higher Bebington; F. A. Browne, county architect, Chester.

Colchester.—Public library, for the Corporation; borough engineer.

Coventry.—Extensions to the Coventry and Warwickshire Hospital, Stoney Stanton Road (£112,000), with electrical work; Armstrong & Gardner, architects.

Crewe.—Baths (£39 866) and maternity home extensions (£10,590); borough surveyor.

Deal.—Modernising fish preserving factory and plant; S. W. Smedley, managing director, National Canning Co., Ltd., Ocean House, Great Tower Street, London.

Derbyshire.—Nurses' home, Bretby Orthopædic Hospital, for the C.C.; county architect, Derby. School, Swadlincote (£10,500), for the County E.C.; A. H. Harris & Son, builders, Marehay, Derby.

Doncaster.—Fire station, Leicester Avenue, Intake (£16,455), with electrical work; R. E. Ford, surveyor.

Dorchester.—Extensions to isolation hospital (direct labour), also electricity showrooms and offices, Trinity Street; borough surveyor.

Dorsetshire.—Children's homes, Gloucester Road, Dorchester; county architect, Dorchester.

Douglas (I.O.M.).—Stores, Nelson Street; Heron & Brearley, Ltd. Reconstruction of Tramway Terrace depôt; borough engineer.

Dovenby (CUMBERLAND).—Extensions to mental colony (£30,000); Cumberland, Westmorland and Carlisle Joint Committee.

Dumfriesshire.—Enlargement and improvement of Dumfries Academy (£43,300), for C.C.; county clerk, County Buildings, Dumfries.

Ealing.—Alterations and additions, Mattock Lane Health Centre; borough engineer.

Epping (ESSEX).—Houses (£7,928), for the U.D.C.; Mr. Higgins, builder, Harlow.

Esher (SURREY).—Estate development, Moleseyhurst (700 to 750 houses); W. J. Lavender & Farrell, Worcester Park.

Eton.—Extensions to physics laboratory, Eton College; T. Worthington & Sons, architects, Oxford Road, Manchester.

Falkirk.—Shop and warehouse, Princes Street (£5,000); Alexander Young, house furnisher.

Felling-on-Tyne.—Public baths; U.D.C. surveyor.

Gellygaer.—Isolation hospital extensions for the U.D.C. (£5,538); Evan James, builder, Ystrad Mynach.

Glasgow.—Extensions, Mitchell library and new branch libraries (£100,000); city engineer.

Golspie (SUTHERLAND).—Extensions to Lawson Memorial Hospital; Horne & Murray, architects, Golspie.

Gt. Yarmouth.—Alterations to "Ship Inn," Middlegate; E. Lacon & Co., Ltd.

Hebburn-on-Tyne.—Laboratory for Wailes Dove Bitumastic Co.; L. J. Couves and Partners, architects, Carliol House, Newcastle. Additions to offices; Charlton Blue Safety Coaches, Ltd.

Hyde (CHESHIRE).—Cinema, for the Union Cinema Co., Ltd., Wardour Street, London; Fred Bernhard, managing director.

Irish Free State (DUBLIN).—New building for the Male Health section, James's Street institution; McDonnell, Dixon & Downes, architects, 20, Ely Place. (WATERFORD).—Houses (53); D. Sheedy, borough surveyor. (LIMERICK).—Houses (90), Killalee; city engineer.

Jarrow-on-Tyne.—Alterations to the "Golden Lion Hotel" and the "Royal Oak Hotel," for Newcastle Breweries, Ltd.; D. Glen, builder.

Kirkby-in-Ashfield.—Public baths (£10,000 to £11,000); U.D.C. surveyor.

Lanark.—Waterworks and service reservoir (£200,000) with electrical work; water engineer.

Lanarkshire.—Health institute and library, Bellshill (£11,200); county architect, Hamilton.

Leeds.—Extensions to dairy (electrical work); Industrial Co-operative Society, Ltd., Albion Street. Infant and junior school (electrical work), Bramley; Empsall, Clarkson & Clarke, architects, 17, North Park Road, Manningham, Bradford. Police and fire station, York Road (electrical work); F. Broadbent, architect, Civic Hall, Leeds, 1.

Leicester.—Houses (30), Desford; A. S. Phipps, architect, 39, London Road. Cinema, Markfield; Alcock & Grieves, architects, 11, Leicester Road, Loughborough.

Little Hulton.—Houses (50), Clegg's Lane; Suburban Building Co., Councillor Lane, Cheadle.

Manchester.—Sterilising room and laboratory at Christie Hospital, Wilmslow Road, Withington; W. Thorpe & Sons, Ltd., builders, Chester Road, Old Trafford. Houses (78), Woodlands Road, Woodhall Road, Green Stead Avenue and Parslow Avenue, Cheetham; T. Fogarty & Co., builders, Tyson Street, Cheetham. Rectory and parish hall, Brownley Green, Northern Etchells, for the Rev. Colin Lamont, St. Luke's Church, Wythenshawe; H. Matthews & Sons (Builders), Ltd., 129, Stockport Road, Ardwick. Additions to premises, Stretford Road and Higher Cambridge Street, Hulme; Pauldens, Ltd., Stretford Road. Church, for Rev. Fr. J. M. Routledge, the Presbytery, Moston; Hill, Sandy & Norris, architects, 9, Albert Square. Additions to bakery, Lyndhurst Street and St. Leonard Street, Chorlton-upon-Medlock; R. Shorrock & Sons, Ltd., bakers and confectioners. (All including electrical work).

Middlesbrough.—Dairy for Brunton's Grade "A" Dairies, Ltd.; J. McCreton, Ltd., builders, West Terrace, North Ormesby. Remand home, for the E.C.; P. Haswell, architect, Woodlands Road.

Midhurst.—Houses (40), various sites; Humphrey & Son, builders, Wittering.

Morpeth.—Reconstruction of the "George and Dragon Hotel"; J. Wilson, builder, Oldgate.

Newburn-on-Tyne.—Welfare centre; Rigby & Appleton. Houses (16); U.D.C. surveyor.

Newcastle-upon-Tyne.—Reconstruction of Walkergate school (£10,000), for E.C.; E. Thompson, 12, Grey Street. New school, Denton (100 places); director of education. Alterations to the Darnell Hotel, Moor Street; Hetherington & Wilson, architects, 52, Westgate Road. Infants' hospital block; city engineer. Houses (45), Allendale Road; R. A. Gofton & Sons, builders, Pykerley Road, Whitley Bay. Houses (35), Fairholme Road site; R. W. Bell & Co., builders, 18, Coldstream Road. Remodelling of premises in Northumberland Street for Messrs. C. G. S. Buist, Ltd.; Parnell & Son, Ltd., builders, Lodge Causeway, Fish Ponds, Bristol. Additions to Congregational Sunday School hall; J. Jackson & Sons, builders, Corporation Street. Houses (28) in Coventry Gardens; I. Gold & Sons, builders, Clayton Street.

Newport (I.O.W.).—Reconstruction of the Medina Cinema, High Street; M. & O. Collins, architects.

Northallerton.—Court house (£23,862); G. W. Lazenby, contractor, Ferryhill, Co. Durham.

Northiam (SUSSEX).—R.C. church, presbytery and parish hall, Douce Grove; priest-in-charge.

Norwich.—Houses (200) and three-storey flats; city engineer. Extensions to Public Assistance institution (£10,637); T. Gill & Son.

Oldham.—Branch bank, King Street (electrical work), for Ashton-under-Lyne and District Trustees' Savings Bank; Whitworth Whittaker, Ltd., Rochdale Road.

Oxford.—Medical ward, with nurses' home, Radcliffe Infirmary (£8,000); governors. Houses (230), Wolvercote site; city surveyor. Employment exchange; H.M. Office of Works, King Charles Street, London, S.W.1.

Perth.—Airport and municipal buildings (electrical work); burgh surveyor, 16, Tay Street. Ice rink; H. J. Bell & Co., architects, Perth.

Rothesay.—Pavilion, Argyll Street (£30,000), and indoor swimming pool on site of aquarium (£26,500), for E.C.; Alex. Stephen, 41, High Street.

Salford.—R.C. school (450 places), Irlams-o'-th'-Height; Rev. T. J. O'Shaughnessy.

Scampton.—R.A.F. aerodrome; Air Ministry, Alexandra House, Kingsway, London, W.C.2.

Scarborough.—Private hotel for J. F. Bramhald; F. Baker, architect, York Place. Additions to convent, Queen Street; Jones & Rickaby, architects, 102, Westborough. Factory, off Beaconsfield Road, for E. Hunter; L. N. Sanderson, architect, York Place. Additions to the Alexandra Laundry buildings, for C. N. Scriven; R. A. Sowersby, architect, 18, Columbus Ravine.

Shropshire.—Grammar school, Mossfields, Whitchurch (electrical work); A. G. Grant, architect, 5, Belmont, Shrewsbury.

South Shields.—Houses (172); R. Brown & Sons, Ltd., Lord Street.

Stanley (Co. DURHAM).—Swimming baths, High Street, for the U.D.C.; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Stockton-on-Tees.—School (320 places); borough engineer. Houses (52) in Stockton Road; Thornton & Sons, builders, Billingham-on-Tees.

Stokesley.—Houses (22); Ormesby; H. W. Pilkington.

Sunderland.—Hall and open-air theatre (£10,000); borough engineer.